20TH ANNIVERSARY SPECIAL ISSUE

FAST COMPANY

MARK ZUCKERBERG

He's 31.

He's Built Facebook Into a $290 Billion Business.

And He's Just Getting Started.

MALALA

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ELON MUSK

His New Plan to Save the Planet

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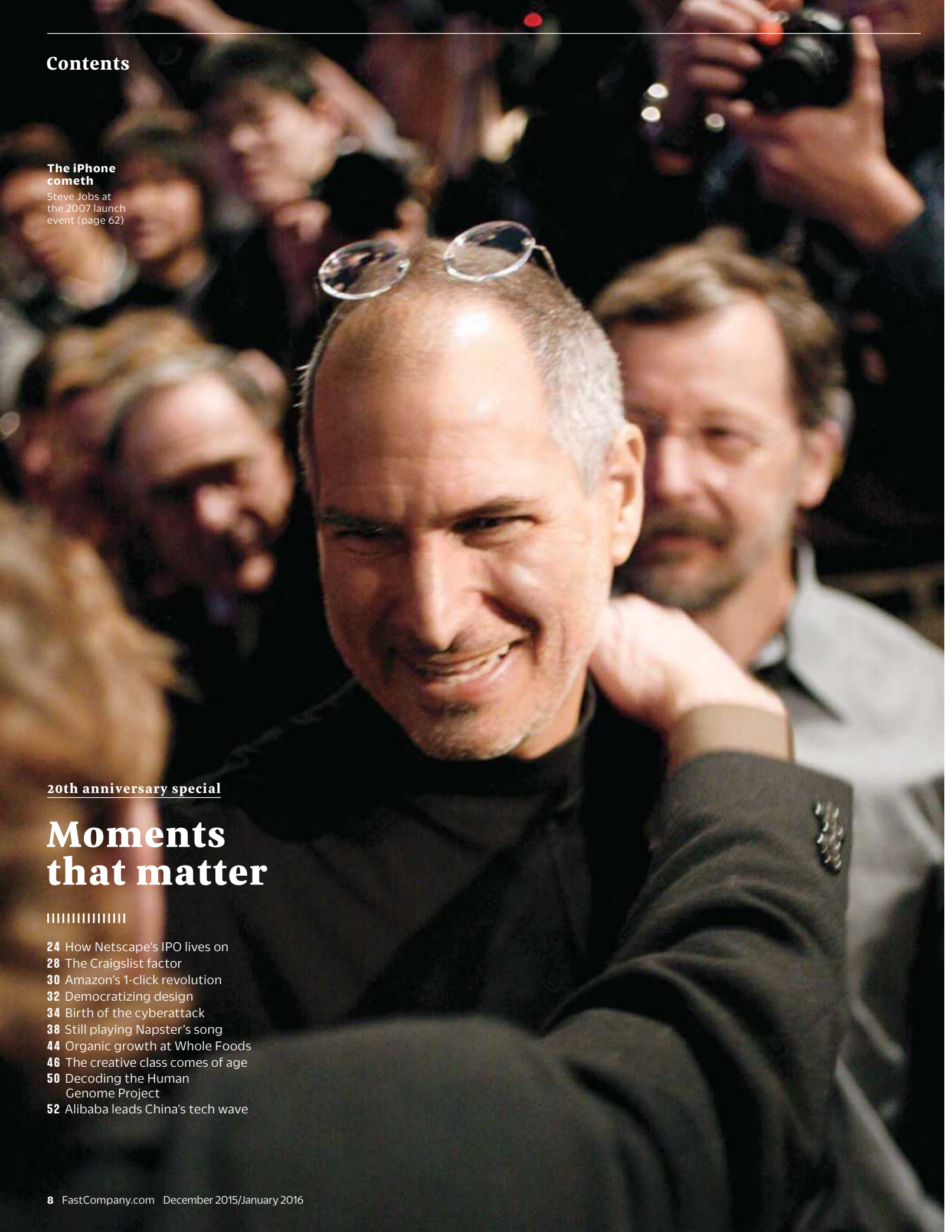


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On the cover:
Photograph by Pari Dukovic

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Photograph by Samantha Casolari

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Elyor Nematov/Global Assignment

Photograph by Elyor Nematov

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Twenty predictions for the next 20 years

By Robert Safian

The doctor handed me the scissors. As I pressed down the blades, snipping the umbilical cord, I looked up at my wife. She was smiling, holding our newborn son.

That was 20 years ago. Our baby is now 6 feet tall and a junior in college. When I look at him, I see all the stages of his life in one continuum, the toddling and the tantrums, the laughs and the arguments, the late nights coaxing a crying infant to sleep and waiting for a teenager to come home.

Fast Company turns 20 this month too, and the world has changed dramatically since the cover of issue No. 1 declared "Work Is Personal. Computing Is Social. Knowledge Is Power. Break the Rules." Yet that manifesto is more relevant than ever. How we interpret those words has evolved—we did not predict an App Store or an Oculus Rift—but their spirit has become central to our culture.

We celebrate birthdays to remember all that has gone before, and also what is to come. This month, with issue No. 201, we recognize *Fast Company*'s 20th anniversary by looking toward the future. The dynamic change of the past two decades is just a warm-up for what is still to come.

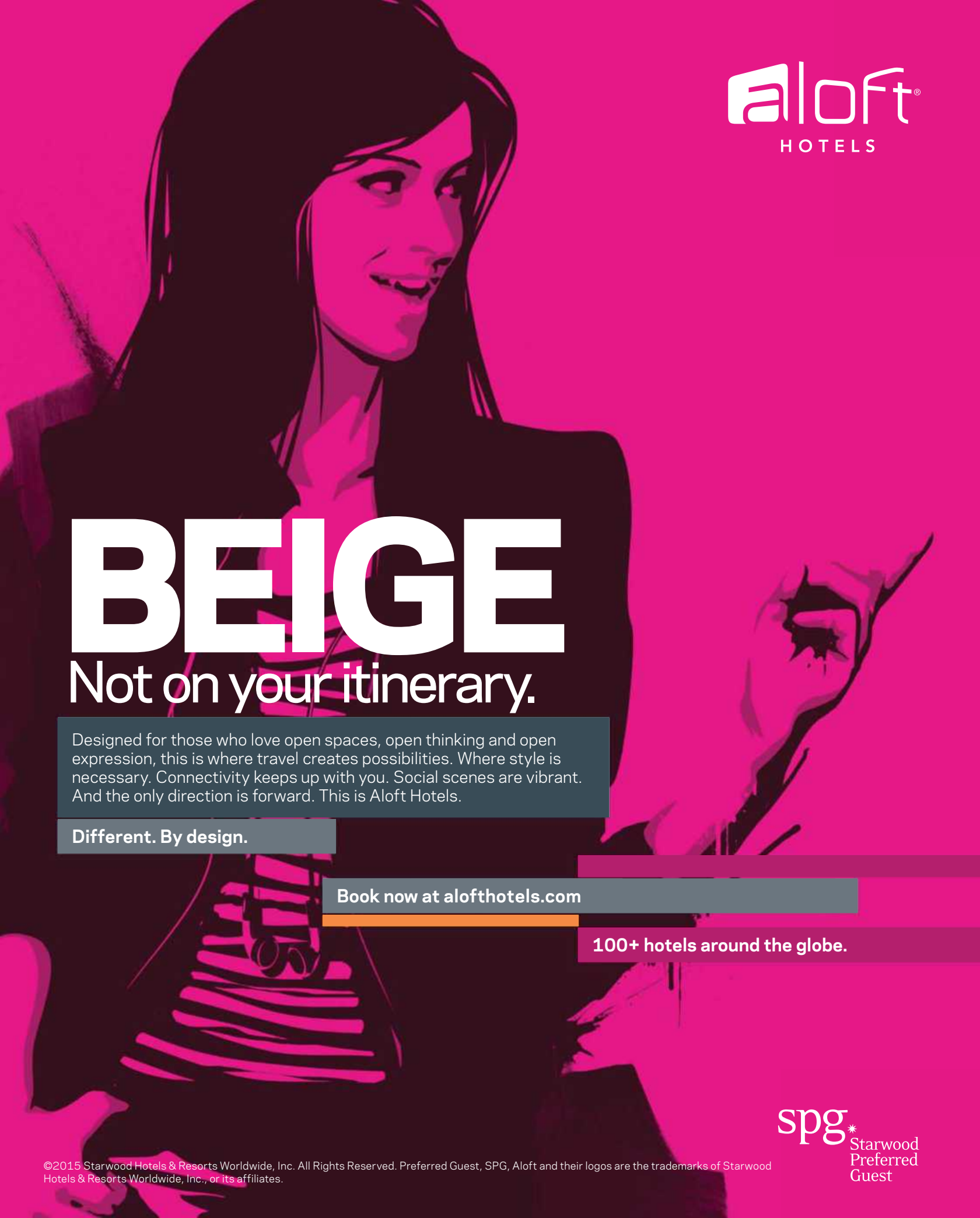


I talked recently about this with CEO Hans Vestberg of the Swedish communications company Ericsson. Because Ericsson builds products for the major telecom providers and cell-phone makers, as well as hundreds of governments around the globe, Vestberg has inside knowledge of everybody's plans—information he cannot specifically reveal but that informs his thinking about where our world is trending.

"Today, there are 7.2 billion mobile subscriptions," he says, "and only 2.9 billion people have broadband," by which he means high-speed Internet access. "But as technology advances, prices will fall. By 2020, 90% of the world's population will be covered by mobile broadband networks. Another five to 10 years further, broadband will have universal reach."

This, Vestberg argues, will have a transformative impact. He points to a historical precedent that is now hundreds of years old: the steam engine. When first invented, its function was to remove water from mines. Only later was the technology applied to other arenas, spawning steamships and railroads and turbocharging industry. The advent of connected mobile technology is just as powerful and equally underestimated, Vestberg says. We are still in the early stages, with implications for health care, education, banking, energy, manufacturing, and more. "Our imagination is our limitation," he says.

Vestberg's predictions of transformation are echoed by those on the frontier in other disciplines: genetics, alternative energy, artificial intelligence, and



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so on. If you travel down the likeliest development paths in each of these areas and then wrap all the advances into one future, you see that we are at a dramatic inflection point.

I have used the phrase Generation Flux to describe this era of transition. Because the changes are coming so fast, there is a rising premium on our ability to adjust, to be adaptable in new ways. This can be scary for some, but it is also undeniably exciting, and for those prepared to embrace this emerging reality, the possibilities are tantalizing.

What follows are 20 observations that we believe will hold fast in the years ahead. They are predictions and, as such, are fraught with limitation and supposition. None of them, on their own, is shocking. That is by design. In combination, though, they outline a world of tomorrow where work is still personal, computing is still social, and knowledge is still power. And where the rules for success will be ever-changing.

1

Speed Will Triumph. The best soccer teams in the world emphasize pace of play over perfection. They recognize that keeping the ball moving quickly is better than waiting and trying to make the ideal pass. As deputy editor David Lidsky explains in the first of our **"100 Moments That Matter,"** beginning on page 22, speed emerged as a business imperative in 1995 with the meteoric rise of Netscape, and it has become even more central in the years since. Constant iteration and redefinition are central features at businesses from Amazon to Google to Netflix, and every industry is now required to embrace that pace. (The unanswered question: Which governments will learn to operate with this speed imperative?) Facebook may be the ultimate expression of iterative change, expecting new initiatives to be imperfect—and relentlessly improving them over time.

2

Mark Zuckerberg Will Lead. When we called Zuckerberg "The Kid Who Turned Down $1 Billion" on the cover of our May 2007 issue, he was a baby-faced 22-year-old with just 19 million users. Today he's still got that baby face, but as technology editor Harry McCracken reports in **"'These Things Can't Fail'"** (page 86), he has grown into an unparalleled leader. Now 31 years old, with nearly 1.5 billion customers across the globe, Zuckerberg is wildly successful yet still underestimated. He has relentlessly improved himself as a businessperson and continues to be focused on learning. This psychological feature, along with the fact that he has a net worth north of $30 billion and a controlling stake in a world-spanning enterprise, virtually guarantees that he will be a bedrock figure in our economic and cultural evolution for decades to come.

3

Malala Will Build. After you've won a Nobel Peace Prize as a teenager, what's next? Malala Yousafzai is answering that question by leveraging her global public image not simply to raise awareness of the educational needs of girls in the developing world, but also to orchestrate on-the-ground programs that will have tangible impact. What her nascent Malala Fund represents, she explains to contributing writer Karen Valby in **"'It's No Longer Just My Voice. It's the Voice of the People'"** (page 102), is an ongoing effort to change societal expectations. Malala herself represents the leading edge of a cohort that is only just being unleashed: young talent growing up in obscure corners of the globe. This generation will increasingly have the tools and opportunity to redefine our world. Malala is just the beginning.

4

Elon Musk Will Inspire. Whether Musk is the real-life incarnation of Tony Stark is not the point. Nor is the ultimate success of his enterprises: Tesla, SpaceX, and SolarCity (though we wouldn't advise betting against them). What matters is that Musk's ideas, and his example, are a catalyzing force for progress on one of the most devilishly complicated issues of our time: climate change. As the world's population grows and the standard of living improves, we will produce more greenhouse gases, more pollution. Concerted, high-impact government action will not materialize unless there is a crisis. What remains, then, is a market-based solution, which is precisely what Musk is dedicated to instigating. In outlining his most audacious plans yet, Musk tells contributing writer Max Chafkin, **"'The Issue With Existing Batteries Is That They Suck'"** (page 110). By exploiting that seemingly modest deficiency, Musk not only wants to build a bigger business, but also inspire us to address our biggest challenges.

5

Technology Will Improve the Human Condition. Science fiction often depicts a dystopian tomorrow. But if you consider the long lens of history, technological advances have consistently improved people's lives. We cannot forget the often cruel and rapacious things

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that have been perpetrated in the name of progress. Nor do we expect an end to the tragedies of natural disaster or disease outbreak, of war or terrorism. Whether by accident or overt design, nuclear, chemical, and biological threats remain constant. But it is also worthwhile to remind ourselves that fears of tomorrow have often been overblown. Perhaps the most telling statistic: Global life expectancy has climbed consistently over the centuries and in the past decade has improved for all regions of the world. That advance will continue unabated.

6

Digital Tools Will Unlock Opportunity. Inequality remains rampant across the United States and around the world. The digital divide has often served to heighten the gap between the haves and have-nots. But rising mobile penetration offers the potential to shift that dynamic. When broadband smartphones achieve global ubiquity (as Ericsson's Vestberg predicts), digital learning tools offered by Khan Academy, Duolingo, and others will transform opportunity in the developing world. The teachers and students of tomorrow will not be confined to classrooms, nor to the countries and cities that can afford them.

7

Democracy Will Be Digital. Naysayers have given many explanations for why voting in the United States does not take place via the Internet: identity authentication, security, reliability. These concerns have all been overcome by businesses such as banks and retailers, and before long government will solve them as well. As a new generation of voters comes to the polls—a group raised on one-click purchases and instant access via apps—the traditional voting process will become untenable. New candidates will establish their credibility by extolling their technological sophistication, and e-voting will be everywhere.

8

Diversity Will Deepen. Those controlling the halls of power in business and government in the United States remain predominantly male and white. This will not persist as our population becomes more heterogeneous. An increasingly diverse leadership will be more successful too: As the pace of change accelerates, we will face knottily complex problems, and the greater the variety of approaches and experiences available to tackle them, the better the likelihood of success.

9

Mission Will Trump Money. Economists have long stressed the power of financial incentives. What's measured is what matters; competition breeds excellence; you get what you pay for. It is all logical, yet in many circumstances it is coming up short. Recent real-world studies have shown that having a purpose associated with work produces better performance than pure financial reward. The next generation of workers will expect to be engaged in their jobs through more than just financial means.

10

DNA Will Be Unstoppable. The decoding of the human genome has launched a wave of new treatments and approaches, as highlighted in **"Our Body of Knowledge Expands"** (page 50). Inspiring as these examples are, though, the impact of genetic data is in its infancy.

11

Medical Training Will Be Rewritten. Modern doctoring begins with a boot-camp experience: endless days of unending shifts, as young interns are forced to ingest—and deliver—diagnoses with reflexlike expertise. As our library of medical knowledge expands beyond any doctor's ability to retain all that information, the doctors of the future will have to become data interpreters, tapping into Watson-like technical tools to both diagnose conditions and optimize treatments. This transition promises to make health care more effective and, ideally, will allow doctors to focus even more on the important task of patient service.

12

Human Empathy Will Be Central. It's not just doctors who can improve their bedside manner. We can all stand to listen and respond with more sensitivity. In fact, as machine learning and artificial intelligence insinuate themselves more deeply into manufacturing and the workplace, the one arena that will never be usurped by technology is human-to-human communication.

13

Entrepreneurship Will Not Be for Everyone. The ubiquity of ABC's *Shark Tank* underscores just how appealing the entrepreneur has become in global culture. Everyone wants to start their own business, to launch their own Zuckerbergian success. Government leaders extol the virtue of the startup world, and more and more young people hope for a future where they can be their own bosses. There's only one problem: Entrepreneurship is hard work that requires both high-intensity risk taking and a steel-stomach capacity for absorbing disappointment. Some people are









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psychologically suited for this roller coaster; many of us are not.

(14)

Bubbles Will Burst. Is there a tech bubble? Can all those billion-dollar "unicorn" startups really be worth so much? Will investors who believe the hype ultimately end up getting burned? The answer to all three of those questions is "yes." Yes, there is a tech bubble *in some places*. Truth is, there is always a bubble somewhere. Some of those unicorns are really worth billions—and some are not. Some investors will get burned; others will get rich. Which is which? We'll know once it happens. Talk of bubble versus no bubble is a distraction for most of us, a parlor game. When major bubbles burst, almost everyone is taken by surprise and even those who aren't are generally upended nearly as much as the rest of us. What's most important, once again, is remaining adaptable: If the arena you're involved in turns out to be a bubble, it will be time to change arenas.

(15)

Simple Will Be More Difficult. New technologies often rise on the promise of making everything simpler, better, and cheaper. Over time, we learn that they often do make things better—and even cheaper—but rarely do things remain simple for long. Consider the advertising marketplace, which once seemed pretty straightforward (network TV ads for all!), but marketers had limited knowledge of who saw their ads and how those prospects responded. Marketers can now target specific pools of customers and track their activity. Yet nothing about the modern ad world is simple: There are more avenues for reaching customers than ever, and managing a variety of social, web, and mobile programs makes the old days of TV's hegemony seem quaintly appealing. Companies like Google contend that things will get easier, thanks to new analytics and programmatic marketplaces. More likely: The industry will become more effective at targeting the right message to the right person in the right way, but it will also be more complex.

(16)

Cybersecurity Will Be Costly. Every company is a "tech company" today because we all use technology to operate (in the same way that we are all "electric" companies because we tap into that grid). The necessary corollary to this fact: We are all vulnerable to cyberdisruption, whether from hackers or our own or others' incompetence. That doesn't mean we will all be disrupted, but it does mean that every enterprise will need cyberprotection in ways that haven't historically been budgeted for. Costs will rise. Count on it.

(17)

China and India Will Dominate. Pundits have long predicted that the "sleeping giants" China and India would awake to challenge U.S. and European economic dominance. In the past 20 years, the progression down this path has not been a straight line—but it has been undeniable. The manifestations have been counterintuitive too: Apple is effectively a China-centered manufacturing giant with an American design and marketing arm; its Chinese rival, Xiaomi, is expanding into India following an analogous strategy. The impact of these rising economies will continue to deepen.

(18)

Food Will Be Healthier. No high-fructose corn syrup. No trans fats. Less salt, sugar, and fat. The supermarket aisles burst with assertions of healthier foods, and it is undoubtedly true that we are more aware of what we are putting into our bodies than ever. Chipotle's and Whole Foods' success illustrate that consumers are willing to pay for higher-quality products and, even more, to demand them. What once was luxury will, over time, become table stakes.

(19)

Cash Will Disappear. Carrying a little emergency money around with you has always made sense, even if you ended up tapping that resource for something less than essential. But that need is rapidly dissipating. First there were ATMs (why carry cash around when you can grab it when you need it?), but electronic payments via phones and chips are the wave that will wash away the need for cash entirely. Penny for your thoughts? What's a penny?

(20)

We Will All Be Family. Phones, planes, and televisions have all served to make the world smaller, and the ongoing wave of technological change will only draw us into closer proximity. We will have less license to ignore the troubles (and challenges) in other parts of the globe, and we'll have a vested interest in maintaining familial peace. Nobody knows how to criticize you quite like your kin—they know your vulnerabilities well—but no one is better at coming to your aid, either. Of these 20 items, this is the one with the largest measure of hope: that our increasing knowledge of and intimacy with one another leads to greater understanding and opportunity for all.

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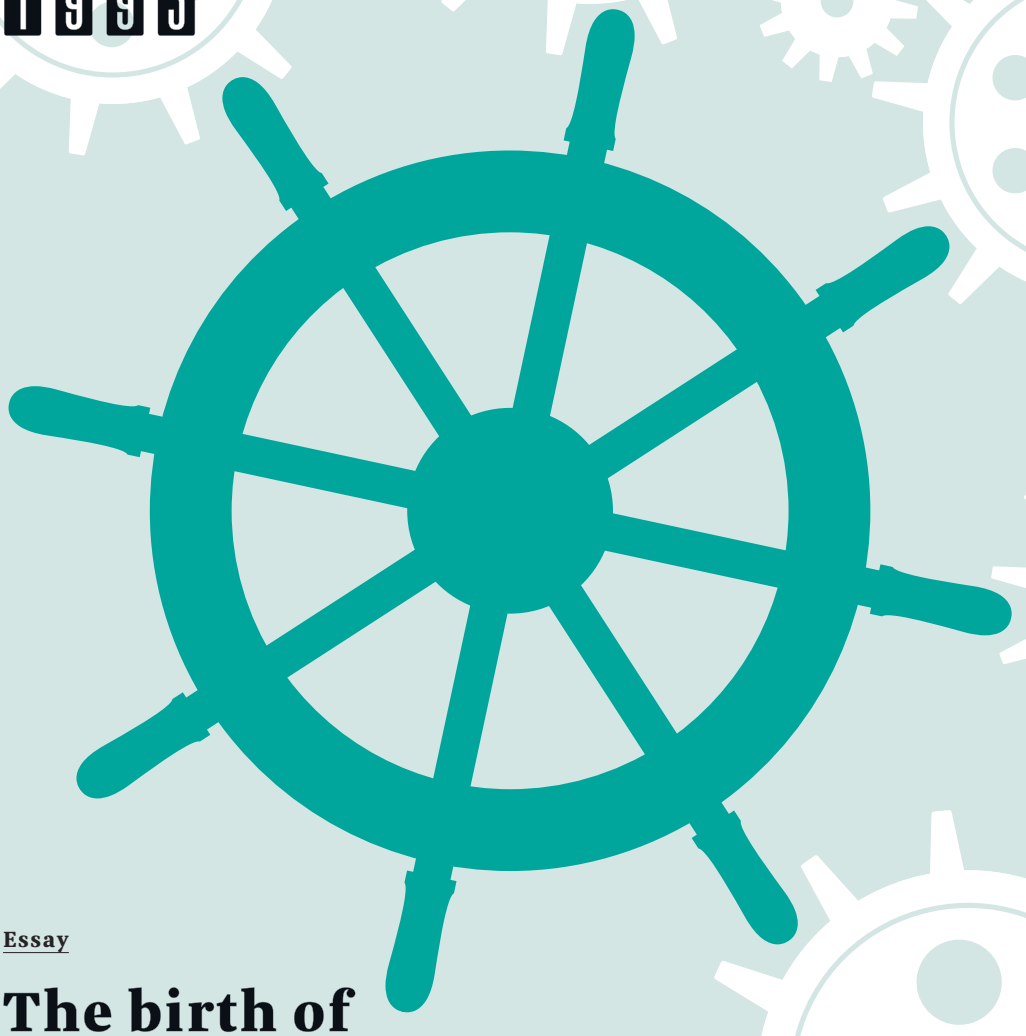
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Light painting and photograph by Christopher Noelle

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1995



Essay

The birth of the fast company

IT WAS THE IPO POP HEARD ROUND THE WORLD: HOW NETSCAPE'S TRIUMPH SIGNALED THE ARRIVAL OF A NEW BUSINESS MODEL—AND A NEW MIND-SET.

By David Lidsky

I first realized that August 9, 1995, would be a day to remember when two coworkers bet each other on the opening and closing price of a new stock issue from a Mountain View, California–based company called Netscape Communications. Their excitement was electric, and it only grew as the stock doubled its offering price from $14 to $28 that morning; by the time it started trading after 11 a.m., the stock had risen to $71. It ended the day at $58.25, giving the company a market capitalization of more than $2 billion. Not bad for a 16-month-old startup with just $16 million in lifetime revenues.

That sort of thing simply did not happen, but Netscape's IPO symbolized many things about the profound changes set to take place in business and culture. Netscape

March

Inspired by the Hawaiian word for *quick*, WikiWikiWeb launches, offering a platform where users can easily alter the content; it's the first collaboratively edited website.

May/June

A then-unknown Jeff Bezos heads to Chicago and sets up a booth at BookExpo America. Five years later, he's the keynote speaker.

September

Consultant and computer programmer Pierre Omidyar launches eBay as a side project. The first item sold on the site is a broken laser pointer. Within a year, eBay.com hosts a quarter-million auctions.

November

Marrying technology with artistry, *Toy Story* is released, pulling in $362 million and solidifying the fortunes of both Pixar and investor Steve Jobs.


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represented a bet on the potential of the Internet to transform society. It was the original Internet platform—something virtually every technology startup now aspires to be. And it was the proto-example of twenty-somethings moving to California to create a company and seek their fortune.

Netscape reinvigorated a Silicon Valley that had become a bit stolid. It revivified the idea that a small team on a mission, led by a visionary like Marc Andreessen, could challenge even Microsoft, then the most dominant tech company in the world. Netscape had a core group of six engineers who were barely out of college when they were transplanted from Andreessen's alma mater, the University of Illinois at Urbana-Champaign, to Mountain View, where they didn't know anyone else. There, they worked 120-hour weeks or more in a race to win the early land-grab on the Internet. They had brought their campus ways with them, sleeping in the office and smoothing out any creative knots by racing remote-controlled cars—and, in the process, inspiring the template for modern workplace culture. "We were working around the clock because that's what we used to do before," recalled Netscape engineer Aleks Totic in an interview with the *Internet History Podcast*. "Five years later, the entire Valley [was] living this same lifestyle." It was a radical rethink of work, from 9-to-5 gray-suited drudgery to something imbued with meaning, purpose, and, ideally, the chance to participate in any wealth created.



Marc Andreessen, pictured here in Netscape's heyday, inspired a generation to seek their fortune in the digital world.

But what came to be young Netscape's defining characteristic—and its most lasting contribution to business—was speed. At a time when software was still sold on disks in shrink-wrapped boxes, Netscape started releasing beta software on the Internet month after month. It would get feedback from customers and pump out two new versions by the time those software boxes even reached stores. Its pace of innovation—and its rush to an IPO—made it the company to emulate. In November 1995, *Fast Company* profiled Netscape as the ur-example of a company living the new rules of competition, writing, "In an economy where even breakthrough technologies become obsolete within a few years, where even the deadliest competitors must change their game in the face of changing circumstances, Netscape Time may be the company's most enduring invention."

Today, we expect—and even demand—the constant iteration that goes into improving the software that runs our lives and our work. Companies such as Walmart release thousands of software upgrades every day. Dig through the update-release notes of your favorite apps. The most common fix? "Performance enhancements."

NETSCAPE'S DEFINING CHARACTERISTIC—AND ITS MOST LASTING CONTRIBUTION—WAS SPEED.

Speed is the value that determines winners and losers in today's hypercompetitive culture. Five years ago, Instagram was one of scores of photo-sharing services. Why did it win? It uploaded pictures faster than anyone else. When the Apple Music trial ended this fall, some techies believed that Spotify had not only survived but thrived because it simply loaded stations faster. Uber is obsessed with how quickly it can get a rider a car. Google's and Amazon's entire businesses are built on playing beat the clock, from serving up answers more quickly to delivering packages within an hour.

It's ironic, then, and a little sad, that speed killed Netscape. If not for Andreessen's status as the country's preeminent venture capitalist, the company would be completely unfamiliar to anyone under the age of 30. Netscape moved so fast that it never settled on a business model and didn't see the opportunity to transform itself into a portal until it was too late. (It bequeathed much of its traffic to Yahoo, which has long outlived Netscape.) Many people, even Netscape employees, blame Bill Gates's anti-competitive practices for the company's demise. Fact is, by late 1997, Microsoft had built a faster web browser than Netscape. Netscape's breakthrough technology had been eclipsed, and it didn't adapt to the new reality. Being first has its advantages, but agility is what's required to win.

Robert Burroughs/Getty Images

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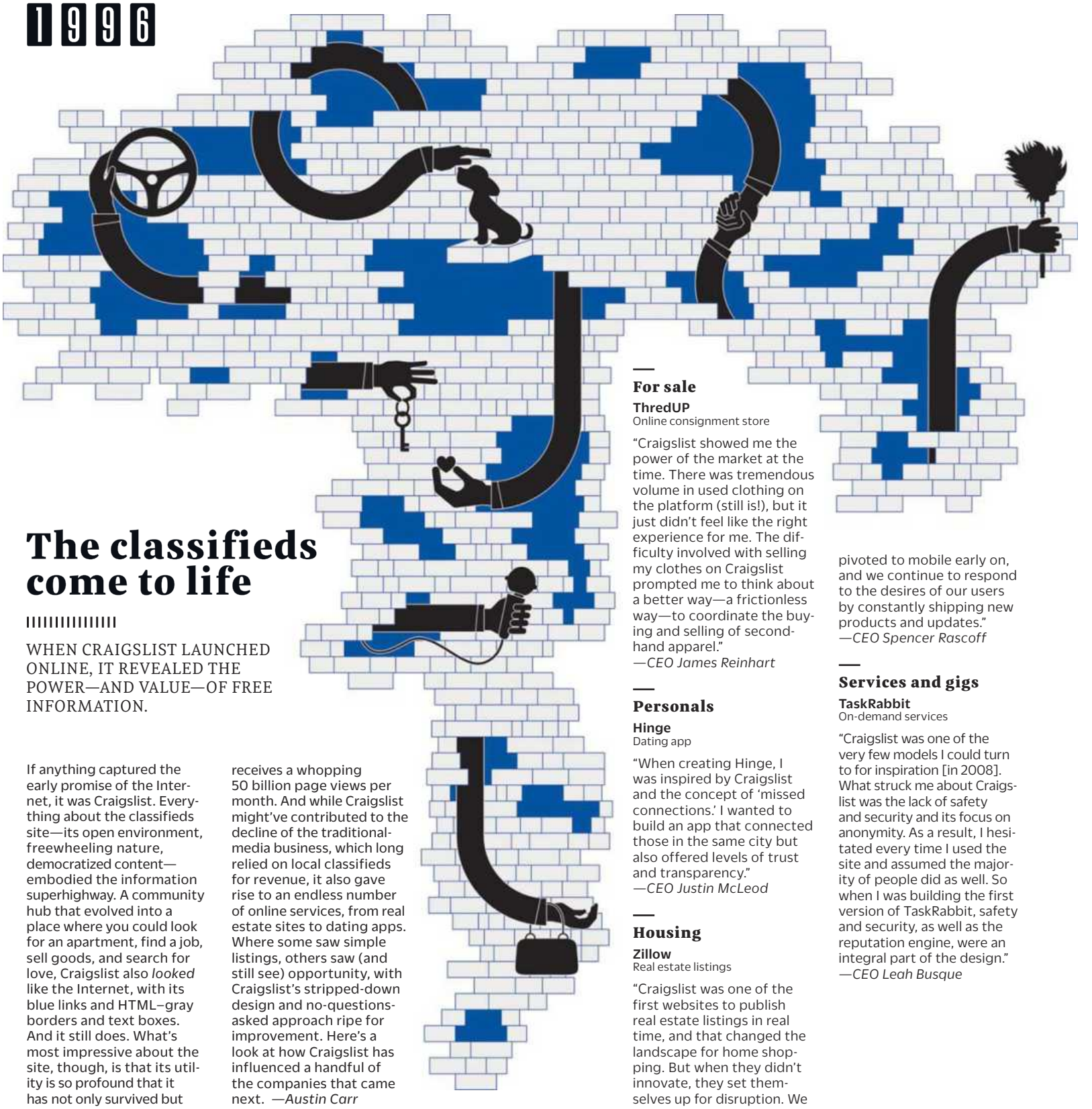


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1996



The classifieds come to life

WHEN CRAIGSLIST LAUNCHED ONLINE, IT REVEALED THE POWER—AND VALUE—OF FREE INFORMATION.

If anything captured the early promise of the Internet, it was Craigslist. Everything about the classifieds site—its open environment, freewheeling nature, democratized content—embodied the information superhighway. A community hub that evolved into a place where you could look for an apartment, find a job, sell goods, and search for love, Craigslist also *looked* like the Internet, with its blue links and HTML–gray borders and text boxes. And it still does. What's most impressive about the site, though, is that its utility is so profound that it has not only survived but receives a whopping 50 billion page views per month. And while Craigslist might've contributed to the decline of the traditional-media business, which long relied on local classifieds for revenue, it also gave rise to an endless number of online services, from real estate sites to dating apps. Where some saw simple listings, others saw (and still see) opportunity, with Craigslist's stripped-down design and no-questions-asked approach ripe for improvement. Here's a look at how Craigslist has influenced a handful of the companies that came next. *—Austin Carr*

For sale

ThredUP
Online consignment store

"Craigslist showed me the power of the market at the time. There was tremendous volume in used clothing on the platform (still is!), but it just didn't feel like the right experience for me. The difficulty involved with selling my clothes on Craigslist prompted me to think about a better way—a frictionless way—to coordinate the buying and selling of second-hand apparel."
—CEO James Reinhart

Personals

Hinge
Dating app

"When creating Hinge, I was inspired by Craigslist and the concept of 'missed connections.' I wanted to build an app that connected those in the same city but also offered levels of trust and transparency."
—CEO Justin McLeod

Housing

Zillow
Real estate listings

"Craigslist was one of the first websites to publish real estate listings in real time, and that changed the landscape for home shopping. But when they didn't innovate, they set themselves up for disruption. We pivoted to mobile early on, and we continue to respond to the desires of our users by constantly shipping new products and updates."
—CEO Spencer Rascoff

Services and gigs

TaskRabbit
On-demand services

"Craigslist was one of the very few models I could turn to for inspiration [in 2008]. What struck me about Craigslist was the lack of safety and security and its focus on anonymity. As a result, I hesitated every time I used the site and assumed the majority of people did as well. So when I was building the first version of TaskRabbit, safety and security, as well as the reputation engine, were an integral part of the design."
—CEO Leah Busque

March

The first PalmPilots are released, complete with address and date books, a memo pad, and 128 KB of built-in memory. Within three years, more than 5 million units are sold. (Apple now hits those numbers for the iPhone in a matter of hours.)

Online travel aide Travelocity launches and is soon followed by Microsoft's Expedia in October. Together they enable anyone with an Internet connection to book flights and hotels.

October

Fox News Channel airs its first broadcast. It soon becomes one of the most-watched and influential cable news networks.

November

ICQ, the first widely used stand-alone instant-messaging service, is released to the public. ICQ later features offline and SMS messaging, games, and emoticons and is acquired by AOL in 1998.

Illustration by Steven Moreau


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1997

Instant gratification

THE LAUNCH OF 1-CLICK WAS JUST THE START OF AMAZON'S SPEED QUEST.

In the mid-1990s, a mere 8% of U.S. consumers felt the web was secure enough to make purchases with a credit card. This was before PayPal and iTunes, when it was still common for people to complete eBay transactions by mailing cash or a check. All that changed in 1997, when Amazon introduced a small feature called 1-Click, which enabled customers to securely store their credit-card information online and make all future purchases with a single tap of their mouse. Not only did it make shopping exceedingly and addictively easy, it also brought the magic of the Internet to life, helping to usher in an era of increasingly seamless e-commerce. CEO Jeff Bezos, naturally, patented the 1-Click idea, and even Apple felt that the technology was so core to the future of shopping that it licensed it for its online store. (Barnes & Noble, on the other hand, ended up in a lawsuit with Amazon after attempting to skirt the patent with its own Express Lane checkout option.) The feature remains a staple of the Internet and is arguably a precursor to many of today's mobile apps, including Uber, Instacart, GrubHub, and Starbucks. Here, four more ways Amazon has reduced the friction of shopping. —*AC*



1

Free shipping

In 2005, Amazon raised eyebrows by offering, for a low annual rate, free two-day shipping for most purchases—a benefit that would cut into its razor-thin margins. But Prime established Amazon as the leading retailer and forced its competitors to match it.

2

Digital downloads

In 2007, Amazon launched its iconic Kindle device and a new method for delivering e-books: Bezos included free cellular in the Kindle—a radical notion at the time—which allowed Amazon customers to download books within seconds.

3

High-tech distribution

The company has spent nearly two decades refining its algorithms so it knows the most efficient way to organize items within its massive fulfillment centers and how best to package and distribute them. In 2013, it even began experimenting with drone delivery.

4

Day-of delivery

With Prime Now, a program Amazon is testing in a handful of U.S. cities, customers can receive orders within 60 minutes. The fast turnaround time has opened the door for the company's Fresh grocery-delivery service.

June

The first version of Wi-Fi launches, allowing Internet users to connect without being physically plugged in. Dial-up's days are numbered.

November

Adding employees, the two-year-old eBay starts a marketing push. The company's PR director cooks up a story about Pierre Omidyar founding eBay so that his wife could trade Pez dispensers—one of the original Silicon Valley creation myths.

December

Toyota releases the Prius in Japan, the first mass-produced hybrid vehicle to hit the market. Three years later, it launches worldwide and becomes synonymous with environmental consciousness.

Jorn Barger, editor of the Robot Wisdom website, coins the term *weblog* to describe his posts, which "logged" his Internet activity. The new phrase—shortened to *blog* two years later—marked the beginning of a change in how we communicate.

Photograph by Mauricio Alejo



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1998

Design for the masses

BUSINESS TRAVEL GOT A LOT MORE INTERESTING WITH THE LAUNCH OF W HOTELS.

Before the first W opened on a quiet stretch of Lexington Avenue in Midtown Manhattan, staying at an American hotel chain usually involved starchy floral comforters and sad, beige carpeting. Though trendy boutique hotels like the Royalton and the Mondrian were already prioritizing design at the time, the W was the first to take a high-end aesthetic and make it available to everyone regardless of status. By the following year, when the young brand opened its 10th outpost, W Hotels were packing in celebrities, socialites, and—most significantly—loyalty-points-hoarding business travelers.

The W was the vision of former Starwood Hotels & Resorts CEO Barry Sternlicht, who, a few years earlier, had realized that while brands such as Pottery Barn and Banana Republic were bringing a new sensibility to the shopping mall, most hotel chains were still peddling an outdated look and feel. So he pulled together a team of architects and designers to try to change that. Their mandate: "To bring good design to people who had never experienced it in a hotel before," says Theresa Fatino, W Hotels' former VP of brand development and design. The first W offered chic, minimalist residential rooms and dramatic public spaces with gossip-page-worthy restaurants and lobby lounges. It was an intoxicating formula, and W Hotels quickly became a white-hot brand. Today, the chain includes 47 hotels around the world and has 40-plus more in development. Its formula has been much-copied: Every major hotel group now has a boutique line (including Marriott's Edition and Hyatt's Andaz), and even the trendsetting Ace hotels, with their gathering-spot public spaces, owe a debt to Sternlicht's original vision of inclusive design. With the W, ordinary travelers could finally enjoy a sophisticated design sensibility along with a good night's sleep. *—Amy Farley*



WHAT'S NEXT FOR HOTELS

(1)

CASUAL WORK SPACES

Because people now work where they sleep, the beds at the **Virgin Hotel Chicago** have padded bucket seats attached to a corner and headboards with lumbar support. **Holiday Inn** and **Courtyard by Marriott** are both introducing mobile desks that let travelers work from sofas rather than chairs.

(2)

PERSONALIZED TECHNOLOGY

Several Starwood brands—**W, Aloft, and Element**—offer guests keyless smartphone room entry, allowing travelers to bypass the front desk entirely. Some of the company's hotels are also experimenting with Bluetooth beacons in lobbies that track guests and further customize their stay.

(3)

GROWN-UP HOSTELS

Who says only backpackers want super-cheap accommodations? Europe's fast-growing **Generator** hostel brand marries stylish, buzzy public spaces with both private and shared rooms in cities such as Paris and Venice. **The Freehand** hotels in Chicago and Miami follow a similar formula.

February

GoTo creates the first successful pay-for-placement search engine, giving advertisers the opportunity to bid to be the first result for specific terms. Google later launches AdWords using a similar tactic with lucrative results.

March

Japanese company NTT DoCoMo opens an R&D lab to work on the world's first 3G network, which will launch three years later.

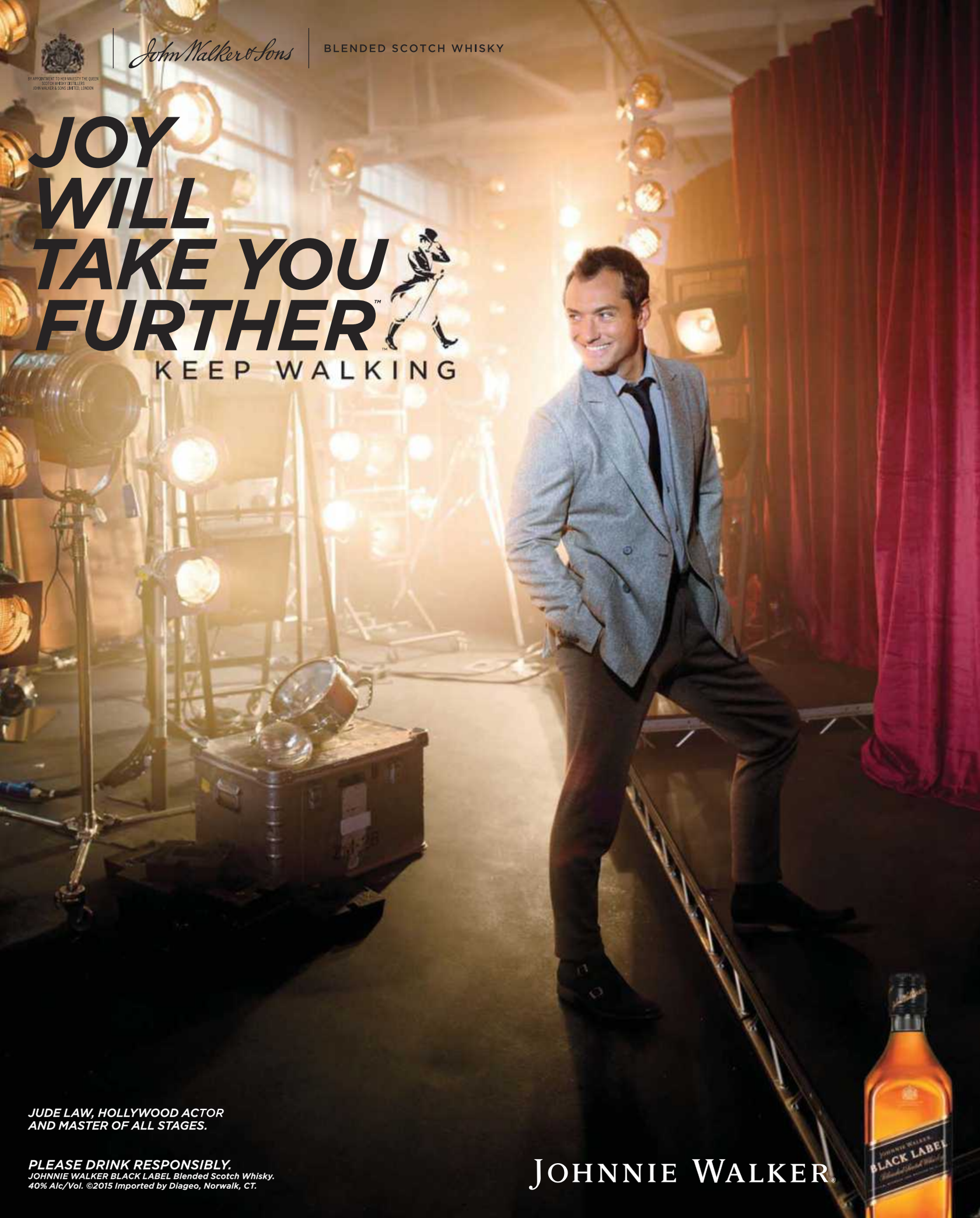
October

The HDTV era kicks off with a nationwide high-definition broadcast of a Space Shuttle Discovery launch. Though few viewers can actually see it in HD (compatible TVs have just gone on sale and are very expensive), it's the beginning of a major change in home entertainment.

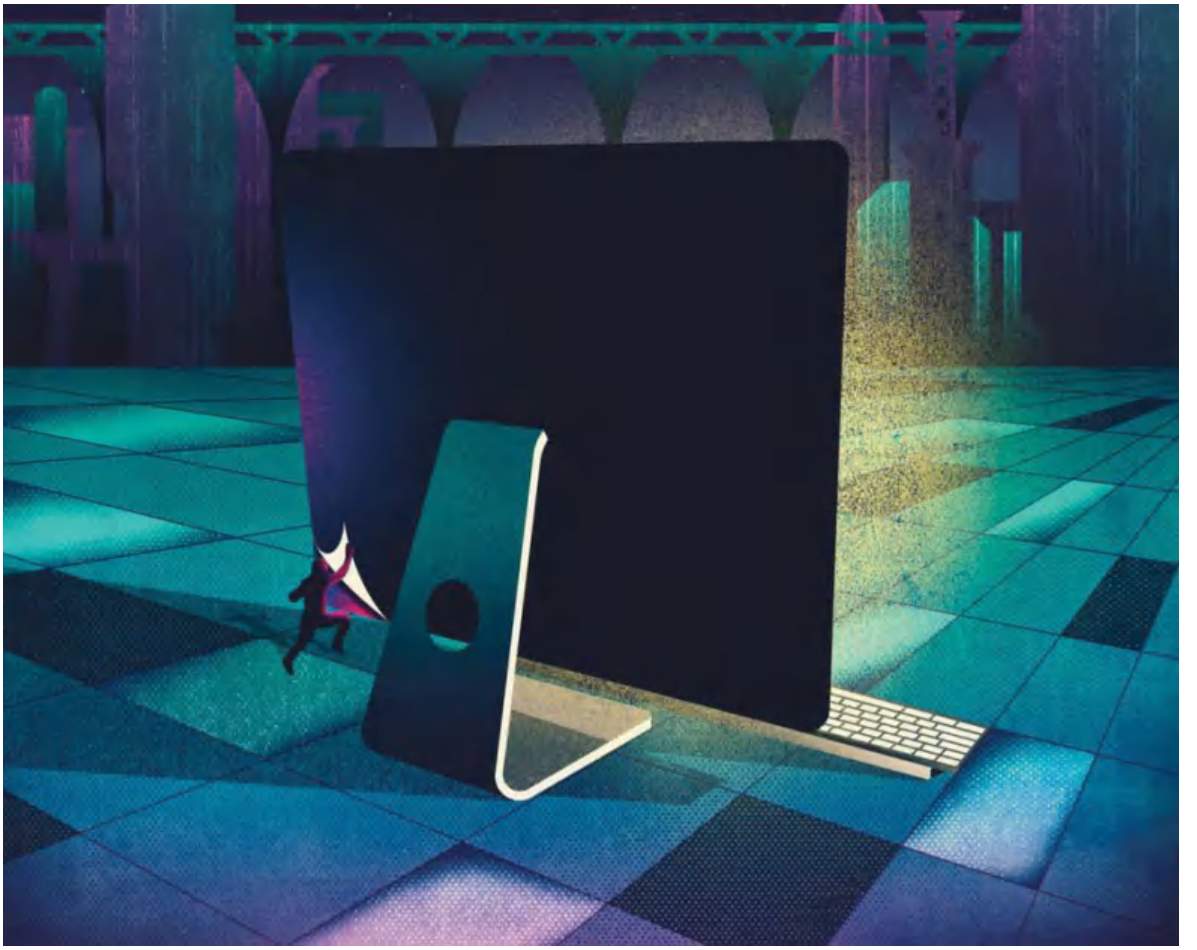
December

Max Levchin, Peter Thiel, and Luke Nosek launch software-development company Confinity. The following year it introduces its signature product, PayPal (Elon Musk and Reid Hoffman come aboard in 2000).

Illustration by Daria Savina


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1999



Quiz

A virus named Melissa

ONE EMAIL—NOT Y2K—PRESAGED OUR CURRENT CYBERHAVOC.

People were nowhere near as jaded about email in March 1999 as they'd eventually become. So when a missive claiming to be an "Important Message" began popping up in inboxes around the world, many folks reflexively clicked on it—and then, as instructed, opened the Microsoft Word file attached.

Bad move. The Word doc—seemingly a list of porn sites—was infected with a virus and automatically emailed itself to the first 50 people in the recipient's address book. It set off a nasty chain reaction that spread to as many as 20% of the planet's business PCs, according to some estimates.

The virus's author called it Melissa (after a Miami stripper) and ended up spending 20 months behind bars. The scheme was more annoying than malevolent, but because it was so effectively (and socially) engineered, it was the first cybersecurity attack that many people experienced directly. In the years since, online threats have grown far more widespread and dangerous. Can you match these six major breaches with the organizations they affected?

—Harry McCracken

(1)

Attackers tricked workers into revealing login credentials using emails that seemed to come from their employer, allowing a break-in that disclosed sensitive corporate data.

(2)

A hacker gained access to celebrities' email accounts by using a "brute force" attack to guess their passwords and then leaked nude photos of them.

(3)

Database commands were entered into text fields on a web page, fooling a server into revealing email credentials for 453,000 users.

(4)

A distributed denial-of-service attack overwhelmed a company's website, while cybercriminals made off with more than $900,000.

(5)

Malware was remotely installed on thousands of payment terminals, purloining credit-card details and other data from at least 70 million people.

(6)

While transferring files to a data center, a contract employee unwittingly released 11 years' worth of names, home addresses, and Social Security numbers.

(A)

Target, 2013

(B)

ICANN, 2014

(C)

Bank of the West, 2012

(D)

The National Guard, 2015

(E)

iCloud, 2014

(F)

Yahoo, 2012

January

TiVo and ReplayTV are unveiled at the Consumer Electronics Show in Las Vegas, promising viewers unprecedented control over what they watched.

February

Marc Benioff founds Salesforce to bring customer-relationship management to the cloud. The startup becomes one of the fastest-growing software companies in the world and ushers in a new, radically efficient way of working.

Victoria's Secret broadcasts its spring fashion show online for the first time, garnering 2 million viewers and more than 100 million hits. The traffic bogs down the site but inspires other brands to embrace webcasts.

October

In the largest-ever media merger in the U.S. at the time, Viacom announces that it will acquire CBS for more than $35 billion. The merger, which lasts just six years, serves as a precursor to the many marriages and breakups to come as media companies try to adjust to the new digital landscape.

Key: 1:B, 2:E, 3:F, 4:C, 5:A, 6:D

Illustration by Pavlov Visuals


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Creative conversation

Napster in the spotlight

WHEN THE FILE-SHARING SERVICE GOT SUED, IT FUELED A DEBATE THAT CONTINUES TODAY.

What is music worth? For decades, the answer had been simple: whatever it cost at your local record store. But with the launch of Napster in 1999, things got confusing. Suddenly there was no reason to hit Tower Records if you wanted the new Metallica single. You could download it—along with pretty much any other song you could think of—without leaving your house… and without spending a cent. Music fans went nuts for Napster, and while many artists were also excited, others pushed back. Metallica drummer Lars Ulrich was the most outspoken opponent, and in April 2000, his band filed a lawsuit against Napster. It was the first time an artist

From top: Shawn Fanning, Lars Ulrich, and Sean Parker were at the center of a lawsuit that helped shape music's future.

January

Presaging the arrival of the sharing economy, car-borrowing service Zipcar is founded in Massachusetts.

May

GPS is cleared for civilian use, paving the way for everyday applications in car-navigation systems, web apps like MapQuest, and location-based technology in smartphones.

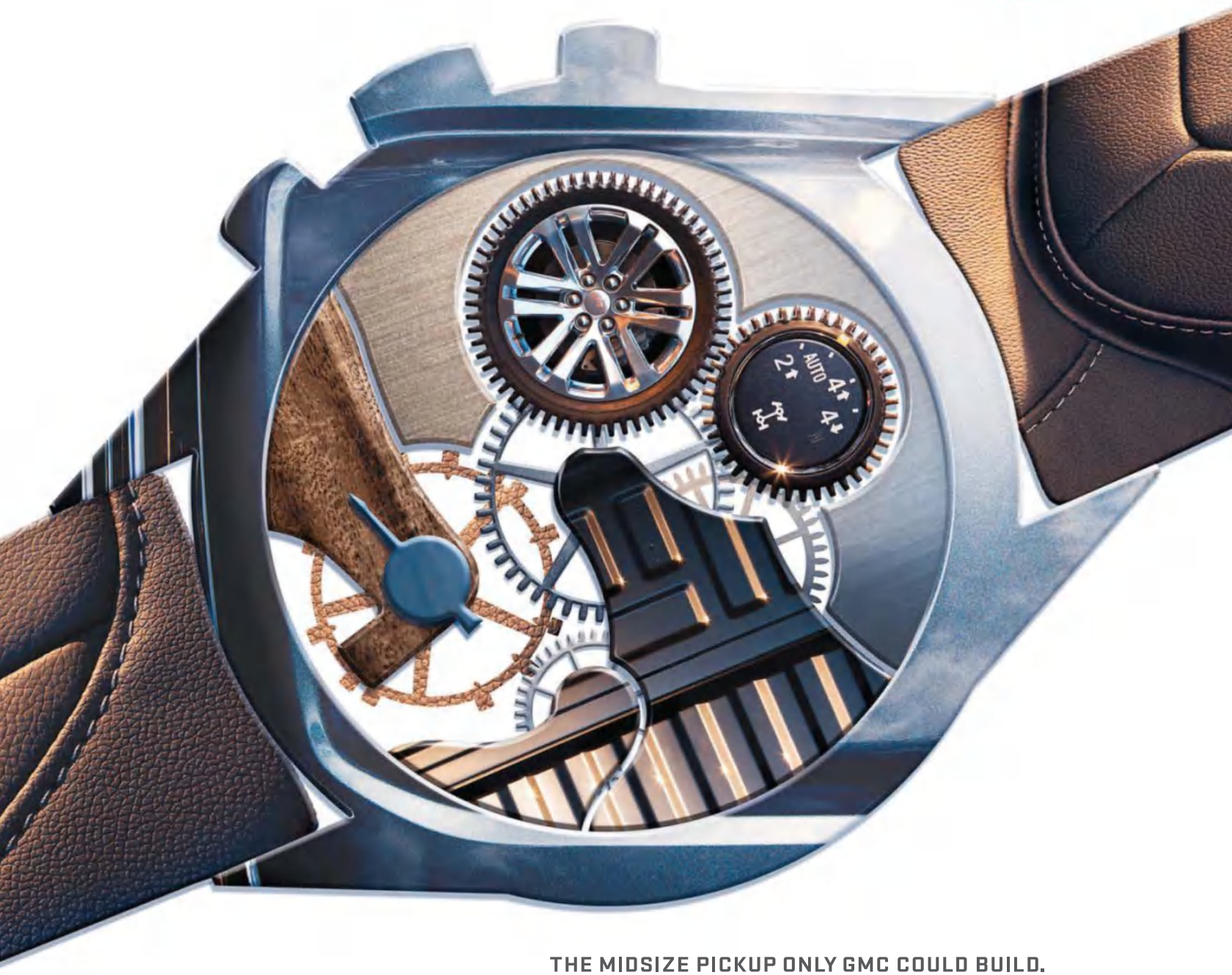
June

Major League Baseball forms MLB Advanced Media, an audio-streaming and interactive media company. It becomes a multibillion-dollar enterprise by providing streaming platforms for HBO, WWE, and the National Hockey League, among others.

Former fashion editor Natalie Massenet launches Net-a-Porter after convincing luxury retailers, including Yves Saint Laurent, Stella McCartney, and Alexander Wang, that selling their goods to the online masses will transform the industry. It does.

Illustrations by Electra Sinclair

PRECISION



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sued the file-sharing service, and it helped usher in a profound reorganization of the music industry. Napster cofounder Sean Parker—who was also Facebook's founding president and today is on the board of Spotify—reflects on his company's revolutionary impact. *—Rob Brunner*

When you and Shawn Fanning launched Napster, how big did you think it was going to be?
Maybe two months in, we had the realization that this was going to be massively interesting. Every time we left the office bubble and went on the street, people were talking about it. You would see yourself on MTV; see yourself on the news. That was really weird. I think the more interesting question was not how big was this going to get. It was, is this a company, or is this a large-scale social experiment we are running that would play out over a period of time and then disappear? I was more on the side of believing it couldn't really survive as a viable company, given that we blindsided the record industry to such a degree that they were in a defensive posture. They were very explicit with us: They were going to crush our prospects of making money, set an example for anybody else who tried to do this.

Why did Napster connect in such a big way?
The obvious part is it was about music. It was the first time ever that the entire catalog of recorded music was available in one place. And it was also the first product that was truly a pure expression of what the Internet could do. Nothing up to that point had captured the possibility of hundreds of millions of people coming together and sharing media.

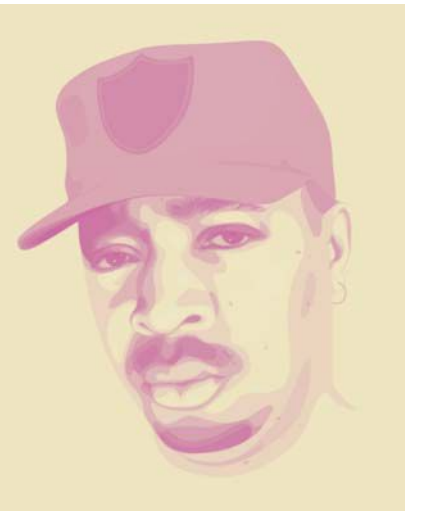
How did you react when you heard about the Metallica suit? It must have been terrifying.
What's amazing is that nobody was ever terrified. There was just a sense of disbelief. Suddenly you're thrown into this dreamlike world where mass-media icons and celebrities are filing litigations against you. You have an understanding that Napster is just symbolic. It's not that they're after you, as much as they're after this cultural shift that they're about to be left out of. Napster was deeply offensive to the cultural norms that existed at that time and to the power structure of the recorded-music business that existed relatively unchanged for [many] years. You could almost talk about it in fantastical terms. We had created this as some sort of mad-scientist experiment. We unleashed some kind of suppressed force in the universe. [It was as though] you're just an observer of this sort of spirit force that's going to war with some existing system. You have a front-row seat to watch this epic showdown, but you're not functionally in control of any of it. In hindsight, you realize that Napster has a huge level of importance in terms of this larger battle between the top-down centralized mass media and the bottom-up decentralized social media we were moving into. Napster is that critical turning point: the first battle that is fought in this war for the hearts and minds of the media business itself.

"LARS AND I HAVE BECOME FRIENDS. WE HANG OUT AND REMINISCE."

Could you sort of understand where Metallica was coming from?
Of course. We really cared about music and were huge fans. So anything short of growing the industry and making sure artists got paid was not an acceptable solution. But the real battle wasn't between whether artists should get paid or they shouldn't. It was between the pre-Internet world of media—which is controlled by gatekeepers, completely centralized—and the post-Internet world of media that was social and decentralized. Napster became the first point where artists were forced to confront the reality that as this Internet thing began to catch on, the degree of control they were able to exercise over their content was going to change. Now Lars and I have become really good friends—so much so that he came to my wedding. We hang out in San Francisco all the time and reminisce.

BELIEVE THE HYPE

Public Enemy's Chuck D was one of the most vocal defenders of Napster, testifying on its behalf before Congress and debating Lars Ulrich about it on television. Here, he recalls his experience with the service.



What did you think of Napster when it launched?
Back then, I said, "Well, Napster is just radio." I'm a firm believer that whether they're downloading or streaming, if somebody wants to hear something, they're engaged. We came up with the philosophy back then that we still use today: Before people buy from you, they've got to buy *into* you. We thought Napster was a great extension of that philosophy. The digital field and format, it wasn't a trendy thing; it was something that was a necessity to reach people who weren't being reached.

So it was more of a tool than a cultural movement?
Well, it *was* a cultural movement. But the thing is, these changes started to happen because the big companies didn't know what to do. One of the main drivers in us believing in Napster was that we knew we were dealing with a world that loved music. The business people did not love music.

What was your reaction to the lawsuits against Napster?
That they were lawyer-driven. I mean, the major record companies are, unfortunately, [led by] businessmen and lawyers. They tell artists, "Hey, look, this is about money." They didn't realize the philosophy of the user. It wasn't just being a bandit, you know? It was a little bit more complex.





Stuck in traffic. *Ideas still moving forward.*





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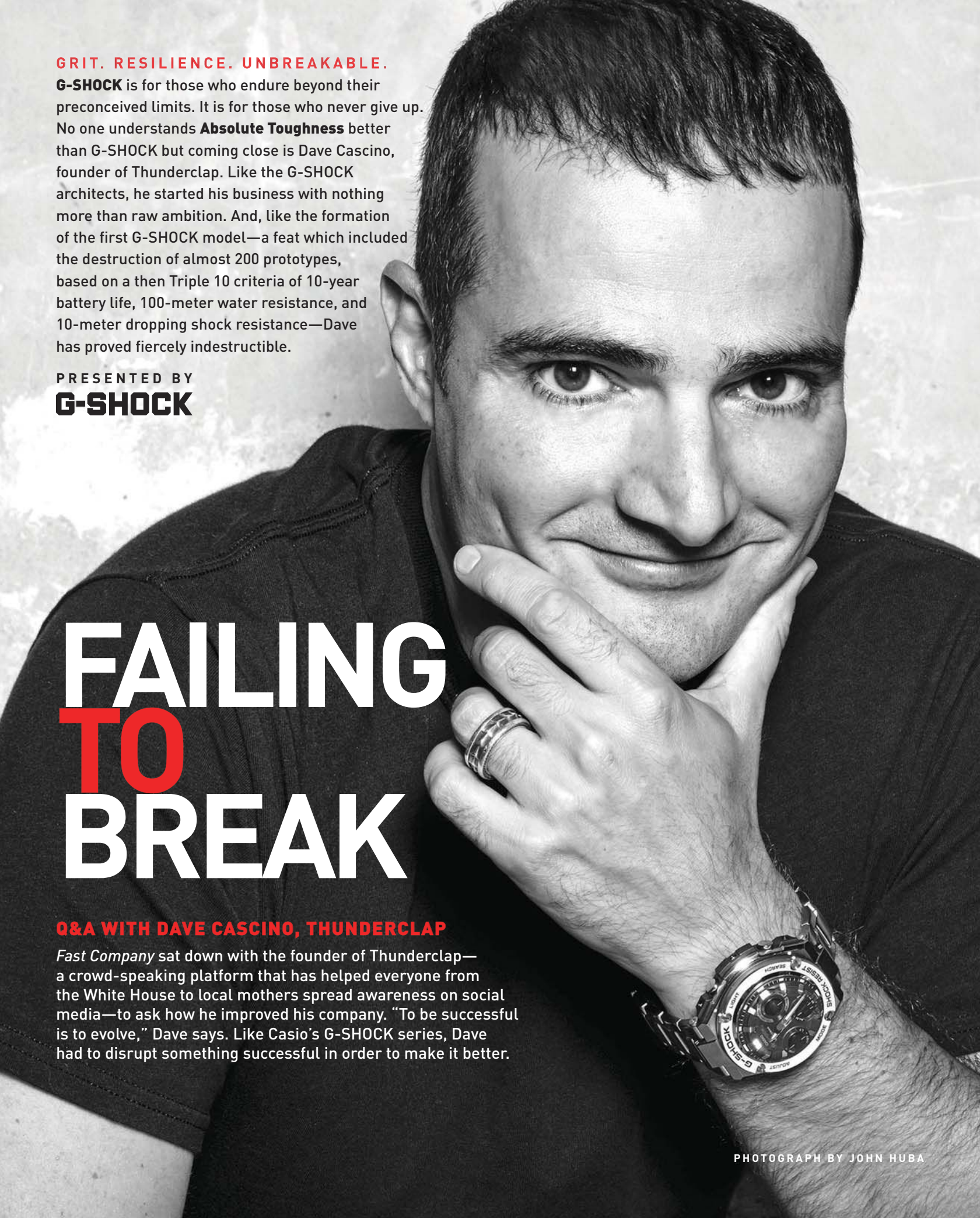
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FAILING TO BREAK

Q&A WITH DAVE CASCINO, THUNDERCLAP

Fast Company sat down with the founder of Thunderclap—a crowd-speaking platform that has helped everyone from the White House to local mothers spread awareness on social media—to ask how he improved his company. "To be successful is to evolve," Dave says. Like Casio's G-SHOCK series, Dave had to disrupt something successful in order to make it better.

PHOTOGRAPH BY JOHN HUBA

WHAT INSPIRED YOU TO BUILD THUNDERCLAP?

I got the idea after becoming politically active and seeing protesters at Occupy Wall Street use something called the Human Megaphone. One person says a sentence and then everyone else repeats it, moving outward in ripples like a giant megaphone. Being a technologist, I wanted to bring this form of social change online, allowing people to amplify their voice.

CAN YOU DESCRIBE A SITUATION THAT REQUIRED YOU TO REINVENT YOURSELF?

In what was either the boldest or stupidest decision of my life, I quit my job two days after I found out I had a kid on the way. I wanted to do this crazy competition called the Startup Bus, where you take three days to build a company on the road from San Francisco to Austin and launch at SXSW. Knowing I was about to be a father and quitting a stable job, it was scary as hell. I could blow through all of my savings, have to loot my kid's college funds, and go bankrupt. That was a tough one, but my wife was behind me the whole way shouting, "Go for it!"

HAVE YOU FACED A SITUATION THAT REQUIRED ABSOLUTE TOUGHNESS?

For a while, I lived in Alaska as a fisherman. Grizzly bears lived there too, and everywhere: in our camps, our house, our trash cans. I was driving alone on the beach one day and I rode past two of them. I was in a three-wheeler, which ended up getting stuck in the sand a few feet away. The more I spun my wheels the further I seemed to sink as they approached. They got so close I could hear the wind coming out of their nostrils. In exasperation, I started to fling my weight around to loosen the car. My heart was beating as fast as I'd ever felt. As they came in to bite, I remembered thinking about my parents. I thought about how little everything in the world mattered: business, family—I could lose it all in a second. I also thought about punching the bear in the nose. But the tire hooked against something at the last second and came unstuck. I sped away. But I'll never forget what I learned from that. It gave me strength as an entrepreneur. Now I don't worry about making a mistake in a meeting or getting something wrong. Everything else is easier after a near- death experience. I'm still alive. So what's the worst that could happen?

BACK TO THUNDERCLAP. WHAT QUALITY IS MOST IMPORTANT TO YOUR BUSINESS?

User experience. We're building an Internet product that is used by a lot of people. Every design decision or product change is going to affect a ton of people, and keeping those people happy is essential. No matter how high the quality of your software, users are never perfectly happy and neither am I. I think dissatisfaction drives quality. "Good enough" isn't good enough. With similar products you have to compete on an amazing experience so if it's not up to par, people will find something else.

WHAT IS YOUR DEFINITION OF SUCCESS?

It's simple: doing what you love. As much as possible. Whether that's raising a family or running a business, finding what truly gets you excited and doing it with excellence and all your heart is success. Even if it's scary.

WHAT ARE THE MOST IMPORTANT CHARACTERISTICS YOU LOOK FOR WHEN WORKING WITH OTHERS?

Passion. People have to love what they do. Skills are important but those can be learned; the right attitude and motivation for working on something cannot be taught. Second, I look for tough people. Unbreakable people. Working in a start up, you have to wear a lot of hats and get your ass handed to you all the time. You're trying to sell a product nobody has seen before so you have to be tough and keep going after it no matter how many obstacles you face. When you hit something that seems devastating, you just have to say, "What's next?"

G-SHOCK's new G-STEEL watches had to be completely redesigned to incorporate steel instead of a traditional resin. The engineering team pushed beyond the limits of their creativity and endurance to produce a proprietary, shock-resistant layered guard structure. With this new tough structure, and solar power technology, they built something tougher than steel. They built G-STEEL.



GSTS110D-1A $350 GSTS100D-1A4 $300 GSTS100G-1A $280

2001

Organic goes mainstream

WHOLE FOODS ARRIVED IN NEW YORK CITY WITH A NEW APPROACH TO EATING AND SHOPPING FOR FOOD.

How does the country's largest natural-foods grocer prove it's not just for health fanatics? Win over the picky palates of New Yorkers: In February 2001, Whole Foods' Manhattan flagship opened in the Chelsea neighborhood, and its aisles were soon flooded with stylish urbanites. That year, the USDA created broad standards to regulate the influx of organic producers. "It was an affirmation that organic is real," says Margaret Wittenberg, global VP of quality standards at Whole Foods, which now has nine stores in New York City (and 400-plus nationwide). Today, 84% of Americans buy organic food at least occasionally, and Whole Foods continues to push the industry in new directions. *—Jessica Hullinger*

1

Affordable organic

To counter natural food's expensive image, in 2002, Whole Foods launched 365 Organic Everyday Value, the nation's first commodity-priced organic line. The popular "generic" brand, which includes packaged goods like cereal, pushed competitors to offer cheaper, private-label organic items.

2

Sustainable seafood

In 2008, Whole Foods began requiring vendors in the U.S., Canada, and the U.K. to undergo audits to prove their fish was responsibly raised and later stopped selling seafood from areas with low fish population. Big chains like Target have committed to similar strategies.

3

A local focus

As a "locavore" leader, Whole Foods hosts farmers' markets and sources produce from vendors that are no more than a day's drive away. In 2014, it created a produce rating system based on soil health and farmworker welfare.

4

Small-biz benevolence

To help grow its organic ecosystem, in 2007, Whole Foods began offering low-interest loans to producers like Buzzn Bee, a honey company that used the funds to buy a freezer. Last year, Whole Foods pledged to provide up to $25 million in loans.

5

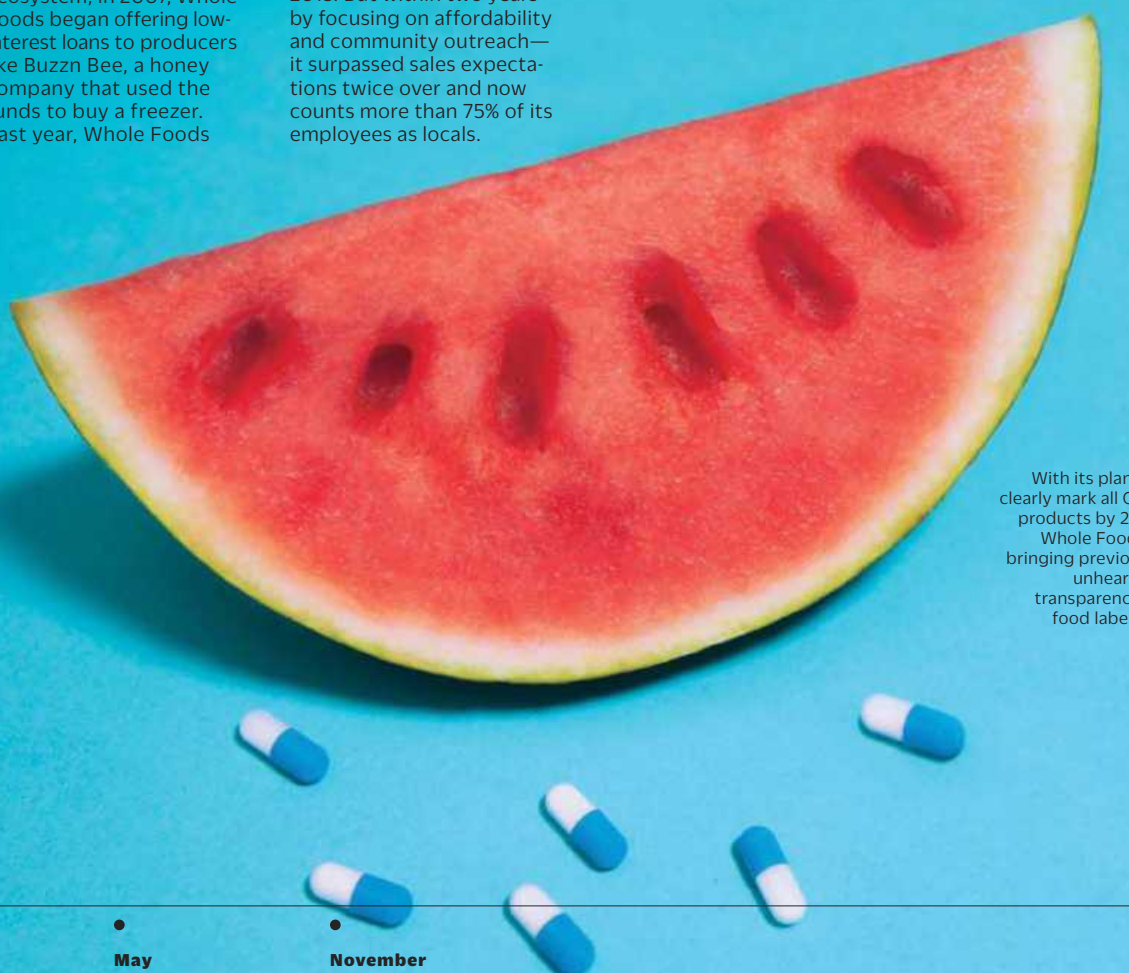
Non–GMO movement

Whole Foods, which offers thousands of GMO–free items, vows that by 2018, all products it sells throughout the U.S. and Canada will be clearly labeled if they contain (or were fed) genetically modified organisms. At least 1,500 brands have applied to become non-GMO-verified.

6

Urban impact

Spectators scoffed when Whole Foods opened in the bankrupt city of Detroit in 2013. But within two years—by focusing on affordability and community outreach—it surpassed sales expectations twice over and now counts more than 75% of its employees as locals.



With its plans to clearly mark all GMO products by 2018, Whole Foods is bringing previously unheard-of transparency to food labeling.

January

Jimmy Wales and Larry Sanger launch Wikipedia, a free online encyclopedia funded by donations and editable by users. Today, it receives hundreds of millions of visitors each month, making it the world's seventh most trafficked website.

May

Amid widespread skepticism, Steve Jobs opens the first Apple Stores in Glendale, California, and McLean, Virginia.

November

The U.S. Justice Department settles its antitrust case against Microsoft. Though it looks like the software giant gets away with a slap on the wrist, the suit makes Microsoft more cautious, opening the door for competitors Apple and Google.

Chris Anderson acquires and begins curating TED, birthing the TED talk and sparking the conference movement.

Illustration by Vanessa McKeown

WE PUT ON SOME EXTRA OUNCES THIS HOLIDAY.

PATRÓN TEQUILA ALREADY MAKES THE PERFECT HOLIDAY GIFT. WITH THIS LIMITED-EDITION, FIRST-EVER ONE-LITER BOTTLE ADORNED WITH AN INTRICATE PEWTER BEE DESIGN, THERE'S JUST MORE TO LOVE.



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The perfect way to enjoy Patrón is responsibly. Handcrafted and imported exclusively from Mexico by The Patrón Spirits Company, Las Vegas, NV. 40% abv.

2002



Chef Justin Severino opened his Pittsburgh restaurant, Cure, in 2011 with his wife, Hilary Prescott Severino.

Portfolio

The new urbanites come of age

THE RISE OF THE CREATIVE CLASS WAS BOTH A BOOK AND A MOVEMENT.

Richard Florida was a little-known urban studies professor at Pittsburgh's Carnegie Mellon when he wrote a book noting a new dynamic playing out in American cities, one in which economic growth was being driven by a burgeoning force of creative workers. *The Rise of the Creative Class* became a best seller and, following the dotcom bubble, a handbook for cities hoping to engender their own creative resurrections by attracting the same kind of talent as Austin and San Francisco—from engineers and architects to poets and musicians. Florida's book also resonated with young people who saw themselves in the creatives he described: individualistic, meritocratic, and open to new people and ideas. Entrepreneurship and innovation, rather than traditional financial success, were their prime motivators. As this generation of self-conscious creators pursued their passions, they helped refashion cities in their image. High-end coffee purveyors, artisanal boutiques, and design-driven coworking spaces spread from Brooklyn to Oakland (and spawned countless parodies). Today, whether aware of Florida's book or not, the creative class continues its urban alterations, most recently in his former backyard. In *The Rise of the Creative Class*, Florida criticized Pittsburgh for its failure to retain creative people. These days, the city is full of them. Here's a look at some people behind Pittsburgh's new energy. —*AF*

May

Spider-Man smashes records with a $115 million opening weekend. The blockbuster encourages Hollywood's embrace of superhero franchises as source material for movies and helps geek culture permeate the mainstream.

NASA's Mars Odyssey spacecraft detects ice on Mars, the first major sign that water—and life—could exist on the planet.

July

Amazon launches Amazon Web Services, buoying the startup economy by providing low-cost infrastructure for new companies. It goes on to become the dominant cloud-service provider, with Spotify, Netflix, Uber, and the CIA among its clients.

September

iRobot releases the Roomba, an automated vacuum cleaner. Despite retailers' initial skepticism, the product is a hit: The company sells 100,000 in its first year, making it the first widely successful home robot.

Photographs by Nicholas Calcott

(1) Hahna Alexander (pictured) and co-founder Matthew Stanton started SolePower, which makes energy-generating shoe insoles, with the help of the city's AlphaLab Gear accelerator.

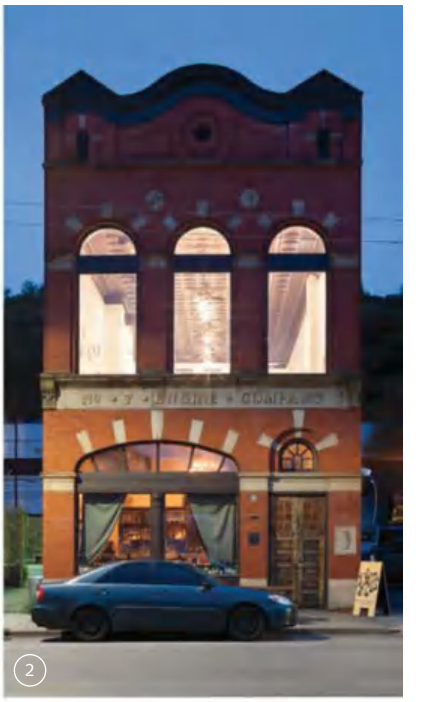
(2) Employees at the restaurant Bar Marco, set in a refurbished firehouse, receive a living wage, health insurance, and equity.

(3) Rick Easton recently opened his Bread and Salt Bakery in a former slaughterhouse.

(4) Rabih Helou (left) and Matthew Ciccone's Beauty Shoppe coworking spaces have helped revive the city's East Liberty neighborhood; they're now expanding to Cleveland.

(5) Product makers are tapping into Pittsburgh's manufacturing roots. Theresa Baughman helps sew designer Wendy Downs's Moop bags in the company's studio.







"PEOPLE ARE MOVING TO PITTSBURGH NOT FOR JOB OPPORTUNITIES, BUT FOR A WAY OF LIFE. WE DIDN'T MOVE HERE FOR A JOB. WE CREATED IT FOR OURSELVES WHEN WE OPENED OUR RESTAURANT."

—Justin Severino











>> DISPATCH FROM...

San Francisco

A Q&A WITH DHANANJA JAYALATH, CEO & COFOUNDER OF ATHOS
Creators of the world's first smart fitness apparel that measures muscle activity, heart rate, and respiration all in real time.

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Q

How do you promote a culture of fitness and wellness internally? As an entrepreneur leading a growing venture, how do you incorporate fitness into your life on the go?

A | Because of the unique nature of our product, our team is quite diverse. We have experts in hardware, software, exercise, data science, visual design, fashion design, textiles, and electronics. The one thing we all have in common is a passion for fitness and health. As a company, we often host internal contests such as our weekly "most intense workout" competition that sometimes (but not always) involve Athos gear. Additionally, we gather as a team at least once a day to do some squats and pull-ups in our office gym. Working out has this incredible ability to reset your body much more effectively than any other activity. When I travel, I try to do cardio and body-weight work and I sometimes work out in airports when I have really long layovers.

>> RAPID FIRE

WHAT ARE THREE THINGS THAT YOU CANNOT TRAVEL WITHOUT?
- **Noise-isolating earbuds**
- **iPad®**
- **Sriracha packets**

WHAT ARE YOUR FAVORITE APPS FOR KEEPING CONNECTED ON THE GO?
- **Slack**
- **Evernote**
- **Box**

WHERE ARE YOU OFF TO NEXT?
- **Vienna: Pioneers Conference**
- **Colombo, Sri Lanka**
- **Philadelphia**


Vienna Marriott Hotel


Philadelphia Marriott Downtown

Q

As the wearable fitness device market continues to grow, how will Athos reach consumers who seek a more data-driven workout?

A | At Athos, we don't believe consumers are as concerned with data-driven workouts as they are with quality workouts. We leverage data to provide actionable awareness that goes beyond just data to make a difference that will improve your workout. Fortunately, we have garnered an incredible amount of awareness through press and word of mouth. We are focused on building a product that provides utility and uses the value it creates to attract more customers.

Q

As a brand so closely aligned with mobile technology, how have Athos products changed as mobile devices continue to evolve?

A | The really exciting change in mobile technology for us has been the increase in processing power that we've seen over the last few years. Five years ago, what we are doing would have been impossible because of the processing power and lack of low-power communication like Bluetooth low energy. These developments have allowed us to interpret, understand, present the data, and optimize for battery life and price point. The next set of innovations in the mobile space that has us excited are the secondary extensions of the mobile ecosystem—watches and glasses (HUDs)—as these open new ways to display and interact with information. We have a few compelling and value-adding experiences we plan to deliver that will highly leverage watches as a platform.

Q

What's next for Athos?

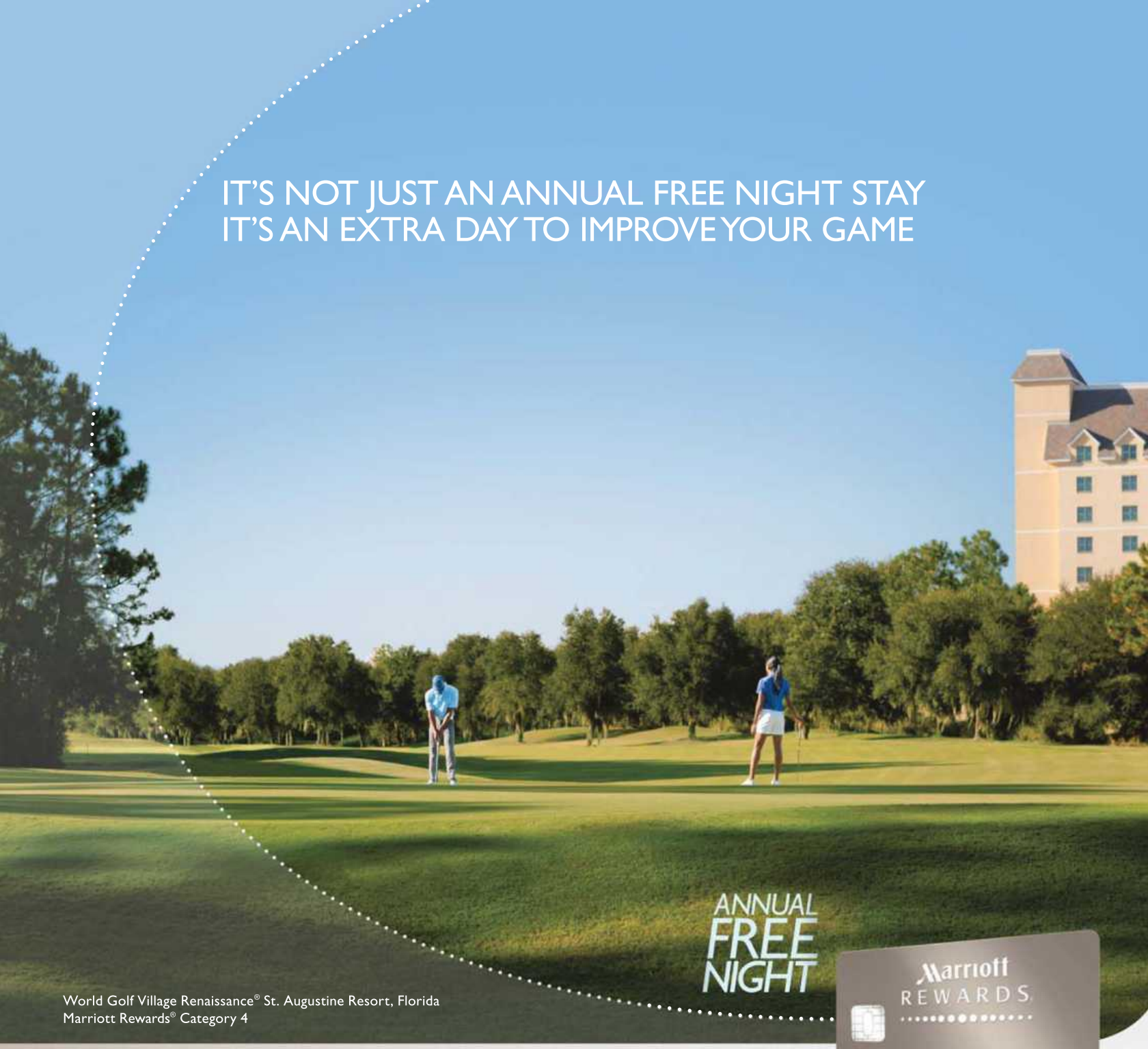
A | As a startup we have to focus on doing what we do really, really well. We are focused on building an incredible experience and providing more value to our customers. Besides that, we are focused on doing what every other clothing company does: designing new apparel to expand our line.

Visit fastcompany.com/dispatch-from to learn more about other on-the-go business owners.



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2003

Anatomy lesson

Our body of knowledge expands

WHEN THE HUMAN GENOME PROJECT FINISHED ITS DNA MAP, IT HAD BIG IMPLICATIONS FOR SCIENCE, MEDICINE, AND BUSINESS.

It was one of the most ambitious projects ever undertaken by the scientific community: a multibillion-dollar, 13-year effort to map the 3 billion DNA letters in the human genome. On April 14, 2003, an international team dubbed the Human Genome Project announced that it had completed its mission—a milestone that helped spur major new directions in research, launch thousands of businesses, and create hundreds of treatments and diagnostic tools—with an estimated $966 billion in overall economic impact. Here are some of the breakthroughs that have come as a direct result of the project.
—Adam Bluestein



(1) **EYES**

GenSight Biologics and Spark Therapeutics are both targeting certain forms of blindness with gene-based therapies that use engineered viruses to fight vision issues at the DNA level. Both companies are in advanced stages of clinical trials.

(2) **LUNGS**

Approximately 4% of cystic fibrosis cases are caused by mutations in the CFTR (cystic fibrosis transmembrane conductance regulator) gene. The drug ivacaftor, which was developed using data from the Human Genome Project, targets this mutation with remarkable success.

(3) **HEART**

CareDx's AlloMap is a simple blood test administered to heart-transplant recipients that measures DNA levels in the bloodstream to detect potential rejection (previously this was often done via an invasive tissue biopsy).

(4) **BREASTS**

Genomic Health and Agendia offer genetic tests that predict the likely effectiveness of chemotherapy and the subsequent likelihood of cancer recurrence, allowing lower-risk patients to avoid unnecessary treatments.

(5) **LIVER**

Genomic information can help determine which drug type and dose will be most effective for a given person. For example, a widely used genetic test can predict a patient's response to a common drug cocktail for hepatitis C. It's one of more than 100 FDA–approved drugs that have labels with genomic-testing information that can help inform treatment decisions.

(6) **COLON**

Genomic testing allows doctors to identify colon cancer patients with tumor mutations in the KRAS gene, who are more likely to respond to the drugs Erbitux and Vectibix.

(7) **UTERUS**

The Human Genome Project has revolutionized prenatal testing and preconception carrier screening. New tests can reveal predisposition to inherited disorders such as sickle-cell anemia and cystic fibrosis. Counsyl offers a preconception DNA test for parents that detects genes involved in more than 100 health conditions.

May

Beyoncé releases her first solo No. 1 single, "Crazy in Love," featuring Jay Z. The song cements the couple's powerful and expanding brand.

June

Fueled by grassroots support and a web- and SEO–savvy team, Howard Dean skyrockets into the Democratic presidential race. Dean becomes the first Internet candidate, raising $15 million in small online donations in the last quarter of 2003 alone.

August

Skype launches, letting users bypass landlines and cell networks to make free voice calls over the Internet. By the time the service introduces video chatting two years later, Skype is on its way to becoming both a company and a verb.

MySpace is created by employees of Internet marketing company eUniverse. In 2005, Rupert Murdoch's News Corp will buy it for $580 million, which he later calls a "huge mistake."

Photograph by Mads Perch

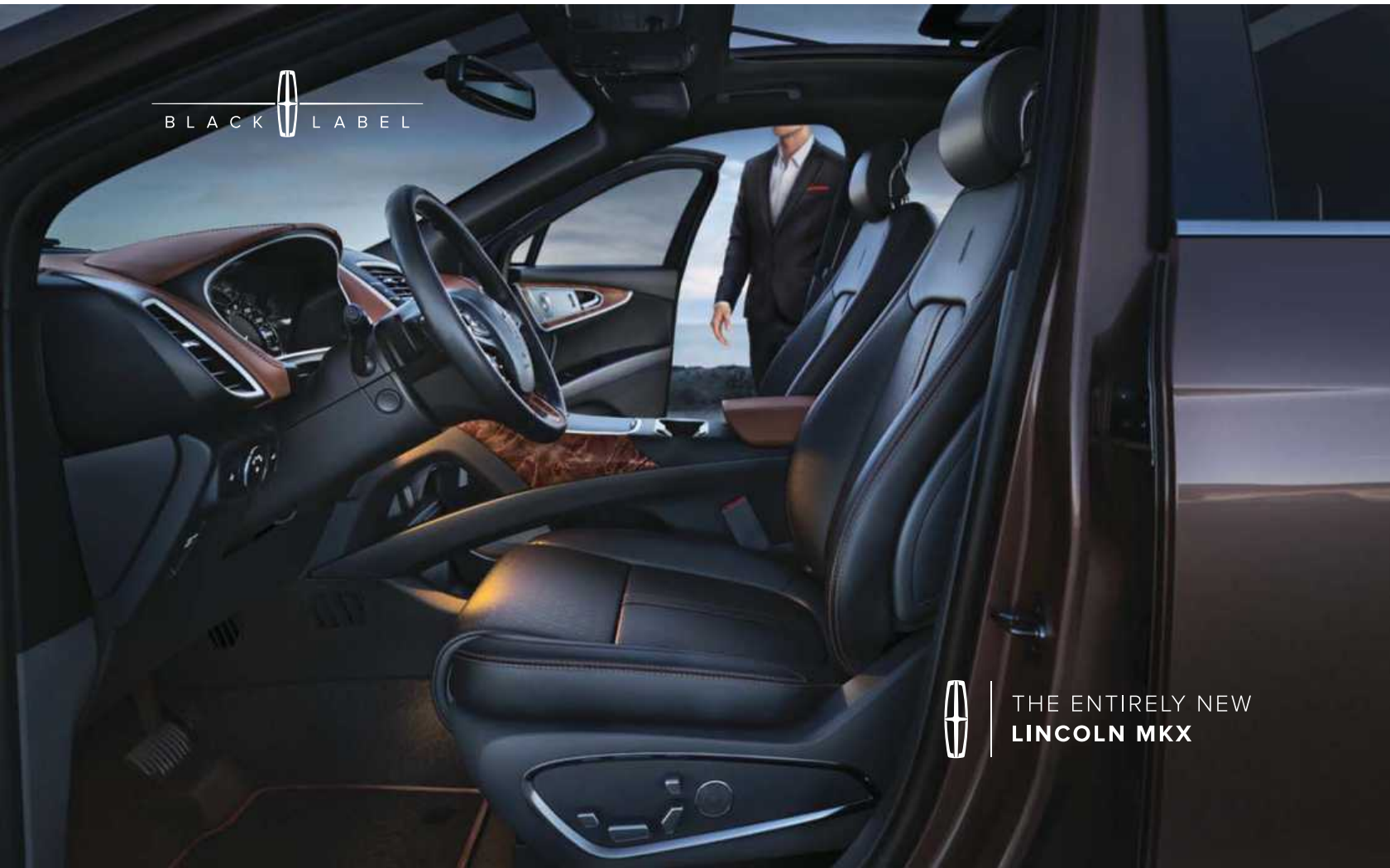
Model: Amanda Rezende at Leni's Model Management; grooming: Joanna Banach; postproduction: Gareth Pritchard

Ah yes, The Zone. You remember that place where you relax your body and mind just enough to shape those random little notions into something useful.

You know: ideas. An elusive place these days, for sure. And yet, the new **Lincoln Black Label MKX*** is doing its small part to help you find it. How? By paying attention to nuances of texture and tone, by using only the top 1% of hides for leather seating. And then there are the exceptional privileges, like having your vehicle personally picked up by a Lincoln Black Label Specialist if it ever needs service, then delivered back, good as new. It's like it turns even your time into a luxury. *Who wouldn't love that?* All to inspire that feeling of effortlessness, yet leaving you in total control. Ah yes... The Zone. Remember? *LincolnMKX.com/BlackLabel*

THE FEELING STAYS WITH YOU.

*Available at participating Lincoln Black Label Dealers only. Pictured here is the Lincoln Black Label MKX Thoroughbred.



2004



Alibaba founder Jack Ma started the company in 1999 from his Huangzou apartment; today, he's worth $22.5 billion.

The rise of the Chinese tech giant

WITH THE LAUNCH OF ALIPAY, ALIBABA TOOK ITS FIRST STEP BEYOND E-COMMERCE—AND KEPT ON GOING.

Is there anything that Chinese conglomerate Alibaba Group doesn't sell? For your next beach vacation, you could book flights on Alibaba-owned Alitrip, buy sunscreen on Alibaba's Tmall, and archive your sun-kissed selfies on Kanbox, Alibaba's cloud-storage platform. And with Alipay, a payments platform similar to PayPal, you could do it all via digital wallet.

When Alibaba introduced Alipay in 2004, it was a signal that the then-five-year-old company's growing ambitions extended beyond pure retail. Still, it would have been hard to imagine that a decade later Alibaba would achieve the largest IPO in history, a $25 billion debut on the New York Stock Exchange. At the time of Alipay's launch, only 7% of shoppers in China had access to the Internet, and the e-commerce market was worth just $750 million.

Then, revolution arrived. Alibaba founder Jack Ma anticipated the value that smartphones would unleash when paired with the consumer demand of China's fast-growing middle class. His strategy: to become the one-stop shop for mobile consumers, with Alipay as the central infrastructure. Retail, messaging, transportation—if there's an app for it, there's an Alibaba solution on hand. Now the annual transaction volume on Alibaba's primary e-commerce platforms is more than double what consumers spend on Amazon.

But there are challenges ahead. In China, competitors like Tencent's JD.com are gaining share of the e-commerce market. At the same time, signs of slowing economic growth sparked a massive downturn in Chinese equities this past summer. The uncertain outlook at home has put pressure on Alibaba to prove that it can succeed in other countries. The company is well positioned for emerging markets, thanks to its expertise in operating in places where logistics are poor. But finding a way to grow in the U.S., a mature market where quality is paramount, is a different story. In the meantime, some Silicon Valley brands are laying the groundwork to compete with Alibaba on its home turf. Apple has filed paperwork in Shanghai to launch Apple Pay, a direct Alipay competitor.
—Ainsley O'Connell

ALIBABA'S MANY SUBSIDIARIES

E-COMMERCE

Alibaba.com *Wholesale marketplace*
Juhuasuan *Daily-deals site*
Taobao *Peer-to-peer marketplace*
Tmall *Business-to-consumer e-commerce*

FINANCE

Alipay *Online payments platform*
Ant Financial *Small-business loans*
Yu'e Bao *Money market funds*

SERVICES

Alitrip *Online travel company*
Aliyun *Cloud services*
AutoNavi *Digital maps*
Kanbox *File-hosting and -sharing platform*
Laiwang *Mobile messaging*
Xiami *Online music distributor*

February

Mark Zuckerberg launches Thefacebook in a Harvard dorm room with cofounders Dustin Moskovitz, Chris Hughes, and Eduardo Saverin—an act that's now the stuff of Aaron Sorkin legend.

June

Backed by Paul Allen, SpaceShipOne conducts the first privately funded flight into suborbital space, winning the inaugural Ansari X Prize and drawing the world's attention to the prospect of commercial spaceflight.

August

A few months after launching Gmail in beta, Google receives a $23 billion market capitalization in a highly anticipated public offering.

October

Former PayPal employees Jeremy Stoppelman and Russel Simmons found Yelp, and, after initially struggling to attract attention, hit on the idea of user-generated reviews. The concept takes off; the site now has 83 million reviews.

Mark Peterson/Redux

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2005



Sam Altman and Jessica Livingston explain why Y Combinator represented a "tectonic change."

Behind the scenes

Venture capital gets flipped

WITH AN ASSIST FROM Y COMBINATOR, STARTUP FOUNDERS TOOK THE REINS.

It used to be that venture capitalists expected a certain amount of control in return for their check, and young entrepreneurs often found themselves on the sidelines of their own companies. But with the success of formidable founders such as Mark Zuckerberg, who in 2005 raised $12.7 million from Accel Ventures without ceding control of Facebook, the power balance began to shift. That same year, Silicon Valley incubator Y Combinator launched with the then-radical notion that founders should be cultivated, not marginalized. Instead of just pumping money into companies, YC created a now-biannual program that selects promising founders, guides them through a rigorous grooming program, then helps them pitch their companies to other investors. Current president Sam Altman—whose company, Loopt, was part of the first-ever YC class—and founding partner Jessica Livingston recall how that idea transformed modern venture capital. *—J.J. McCorvey*

JESSICA LIVINGSTON: At the time, there wasn't anything available for founders who were looking for seed-stage capital. It was either talk to your rich uncle or you had to have a whole business plan mapped out. [YC cofounder] Paul [Graham]

May

Arianna Huffington and Ken Lerer launch The Huffington Post, which they envision as a liberal counter to the Drudge Report. The news site pioneers the niche-vertical model that would inspire outlets like BuzzFeed and Vox.

June

Etsy starts letting people buy unique goods without going to a craft fair. Ten years and 54 million users later, it goes public.

September

Pandora Media and the Music Genome Project launch Pandora Internet Radio, a music-streaming platform that uses data to personalize song selection in real time. Today, the site touts nearly 80 million monthly active users.

December

Saturday Night Live cast members Andy Samberg and Chris Parnell rap their way across New York City on a weekend afternoon. Thanks to the seven-month-old YouTube, "Lazy Sunday" is *SNL*'s—and television's—first breakout digital hit.

Photographs by Carlos Chavarría

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XQ The Super School Project

2005



The dining room at Y Combinator's Silicon Valley headquarters has hosted speakers such as Mark Zuckerberg and Anne Wojcicki.

and I thought, We should be the first gear for startups that just need a little money so [founders] can quit their jobs and focus on working on an idea. We called ourselves Y Combinator, put up a website, and launched the Summer Founders Program. We chose eight startups. In that batch were Alexis [Ohanian] and Steve [Huffman] of Reddit, and Justin [Kan] and Emmett [Shear] of what would later be known as Twitch.

SAM ALTMAN: I was at Stanford when YC was announced, and it spread like wildfire through the computer science department. All of us were like, finally, this is made exactly for us: This is the amount of money we need, and these people sound like they are really cool to work with, unlike venture capitalists, who seem scary.

JL: We didn't want to be a traditional VC. We wanted to be really founder friendly. All of the funding was for common stock. No preferred stock, no extra bells and whistles. Back then, [entrepreneurs] had to get a lawyer and spend, like, $20,000 just to incorporate. Instead, we'd do all the legal paperwork for them and teach them about the business side of things, because we were specifically targeting computer science students and programmers.

SA: With VCs, there were all these terms that were deliberately obscuring what was going on, and I think they liked it that way. *Liquidation preferences* and *ratchets* and *anti-dilutions* and *drag-alongs* and *no-shops*. It was this club that was hard to break into. They would only talk to you if someone they knew introduced you. YC was the first that said very clearly, Here is how we work, here is how you approach us, here's how we make our decisions. We don't need to buy half your company.

JL: We wanted to make quick decisions, because venture capitalists take a long time to decide to invest in you—months, in some cases. We told applicants "yes" or "no" the same day we interviewed them. That was never done before us.

SA: There's a big category of stuff that is not as important as building a product, but if you don't know it, you can't be successful: how to raise money from investors, how to hire and manage people. We left YC knowing all of that. It takes a long time to learn to be a great coder; it does not take a long time to learn all of that other stuff.

JL: I remember our very first Startup School [a one-day conference for aspiring entrepreneurs] in the fall of 2005 at Harvard. I knew something was happening because the auditorium was packed. The vibe was electric. And I remember thinking, Whoa, there is a real interest in startups. We also knew something was going on when Reddit was acquired by Condé Nast [in 2006 for an estimated $10 million to $20 million].

SA: What happened in 2005 was a shift from investors holding most of the leverage to founders holding most of the leverage. That was a tectonic change.

JL: There's also just a more diverse group of founders. The biggest lesson was that more people will start startups if we make it easy for them.



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Image is for illustrative purposes.

2006

Big idea

Walmart turns on the lights

WHEN AMERICA'S BIGGEST RETAILER SWITCHED UP ITS LIGHTBULBS, IT SET OFF A CHAIN REACTION.



It was the year of Al Gore's inconvenient truth and Elizabeth Kolbert's *Field Notes From a Catastrophe*, and public opinion around climate change seemed to be coalescing. So why weren't more Americans buying energy-saving compact fluorescent lightbulbs, or CFLs? In essence, consumers didn't understand why CFLs cost so much more than incandescents and were dubious of their light quality. As a result, nearly three decades after being introduced in the U.S., CFLs were used in only about 6% of homes. How Walmart nearly single-handedly changed that is a study in how a company can use its size for good. —*AB*

The plan

In November 2006, Walmart's then–CEO, H. Lee Scott Jr., announced an ambitious initiative: The company would sell 100 million CFLs by the end of the following year. When put into use, these bulbs would save consumers $3 billion in electricity costs and cut U.S. power needs by the equivalent of 450,000 homes.

The execution

Lighting manufacturers balked, and Walmart's critics leveled charges of greenwashing. But the retailer went all-in, redesigning displays, increasing selection, educating consumers, and launching an affordable private-label brand. "At that time, CFLs were a bicoastal phenomenon," says Noah Horowitz, of the Natural Resources Defense Council. Walmart made sure that people throughout the country were aware of the bulbs.

The impact

Walmart blew past its sales goal: In 2007, it sold 162 million CFLs. Shipments of the bulbs surged across the U.S., surpassing 400 million—more than double the 2006 total. Walmart's massive purchase of CFLs allowed it to dictate specs to its suppliers. It required Energy Star–rated bulbs that met strict performance standards and got manufacturers to reduce the amount of mercury in CFLs. Walmart's actions also helped secure passage of the Energy Independence and Security Act of 2007, which ordered the gradual phase-out of inefficient incandescent bulbs by 2015. As manufacturers increased their focus on CFLs and other such lighting, prices dropped and quality rose.

The legacy

In the second quarter of 2014, shipments of CFLs surpassed traditional incandescents for the first time. But most experts believe the future belongs to LED bulbs, which are even more efficient than CFLs—and increasingly affordable. Today, a CFL, LED, or next-generation incandescent fills one in three U.S. light sockets. "Millions of tons of CO_2 are being avoided," says Horowitz.

July

Angela Ahrendts takes the helm at Burberry. She revives the legendary British fashion brand with a smart digital strategy before leaving for Apple in 2014.

September

YouTube and MySpace vlogger lonelygirl15, whose supposed real-life confessionals filmed from her bedroom had become a hit, is exposed as a professional actress—and becomes a case study in virality.

October

Indra Nooyi steps in as the first female CEO of PepsiCo and soon takes radical steps to push the company beyond soda and chips and into more healthy food.

November

Al Jazeera launches Al Jazeera English, the first English-language news channel headquartered in the Middle East. The channel wins over skeptics with its high-quality international reporting.

Photograph by Wyne Veen



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SYSTEMS UNDER STRAIN

Growing populations are burdening basic resources and human systems:

INTEGRATED SOLUTIONS

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WATER

By 2025, global accessibility to water resources is expected to fall short of demand **by 35%**





WATER MONITORING AND CONTROL SYSTEMS

Hitachi creates wastewater treatment plants, desalinization systems, and end-to-end recycling systems that collect reusable water (from sinks, showers, etc.) for use in agricultural systems

HEALTHCARE

Healthcare expenditures are expected to grow from **10% to 12%** of the global gross domestic product





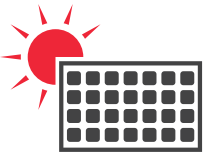
DATA MANAGEMENT AND HOSPITAL EFFICIENCY

Hitachi integrates autonomous data to map broad demographic trends and identify better treatment, improvement, and prevention options for individuals with long-term illnesses

ENERGY

There will be a huge opportunity for energy efficiency and resiliency solutions, as **35 MEGACITIES** will exist by 2025





MICROGRIDS INTEGRATED AS PART OF THE SMART GRID

Hitachi deploys Microgrids selectively to reduce energy costs, strengthen energy resilience, and lower emissions on the edge of the primary grid

TRANSPORTATION

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STREAMLINED RAIL, ROAD, AND AIRPORT SYSTEMS

Hitachi partners with local governments to create new mass transportation systems, such as high-speed rails, while Hitachi engineers work to reduce costs and delays, and improve efficiency of services

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Hitachi Social Innovation. It's our legacy for generations to come.

social-innovation.hitachi.com



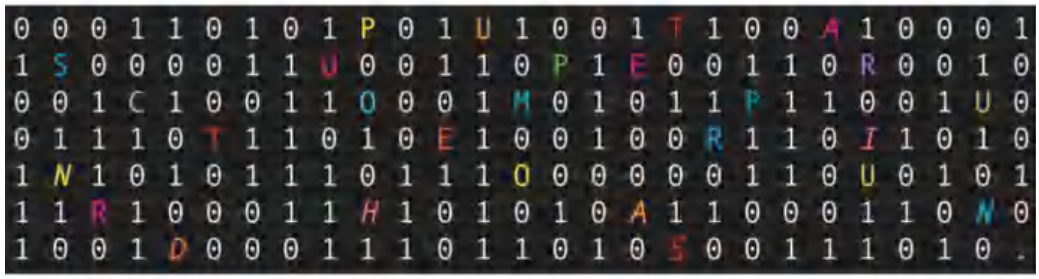
SOCIAL INNOVATION
IT'S OUR FUTURE

The Apple effect

NINE WAYS APPLE CHANGED THE WORLD WITH THE IPHONE

Remember life before the iPhone? We used to watch movies on our living-room TVs, hail taxis by raising an arm, and lovingly crumple photos of our kids into leather carriers we called "wallets." In the eight years since Steve Jobs introduced those ubiquitous little devices in June 2007, they have altered—and, yes, improved—our daily routines in countless ways. But the smartphone's impact has been far greater than just changing the UX of our lives. It's also affected our digital infrastructure, our design sensibilities, and even the way we think about modern labor practices. Here are some of the biggest transformations brought on by the iPhone.
—Mark Wilson









(1) THE SOFTWARE REVOLUTION

When was the last time you heard somebody talk about *software* or *applications*? A year after launch, the iPhone introduced the catchy word *app* and the idea of software that, with a couple of button presses, installs itself and appears as a simple icon. It changed not just how we talk about software but how we consume and use it.

(2) TECHNOLOGICAL MINIATURIZATION

Computers used to be boxy machines that tethered you to a desk or, at best, coffee-shop Wi-Fi. But the iPhone and other smartphones have allowed us to be constantly connected. As a result, Americans now spend more time on the Internet via mobile devices than desktops and laptops.

(3) A SEAMLESS INTERFACE

Before the iPhone, most of us only tapped screens at the ATM. Now, touch screens have become so familiar that children walk up to TVs and are baffled when they can't swipe. And landmark Apple interactions such as pinch-to-zoom have removed the barriers of mice and keyboards to make information tangible and easily accessible.

(4) IMAGE-CONSCIOUS CONSUMERS

By including a camera, the iPhone ensured that people would be able to take photographs at any time, wherever they went, in virtually unlimited quantity. It also gave rise to photo-based social apps like Instagram and Snapchat. As a result, photography has become central to the way we communicate with each other.

(5) **PRODUCTS AS ACCESSORIES**

More than even Apple's beloved Macintosh, the iPhone has shown how important it is to connect elegant industrial design with beautiful and intuitive interfaces. Words like *simple, magical,* and *delightful* now rule product design. And our devices are as much fashion statements as they are digital tools.



(6) **THE NEED FOR SPEED**

In order to keep up with the increased demand for data following the iPhone's initial release, AT&T—the product's original exclusive carrier—introduced nationwide 3G service, at a cost of $20 billion. Today, every major carrier in the U.S. supports 4G speeds that are fast enough to rival that of broadband.



(7) **OUTSOURCING'S DARK SIDE**

Few people thought much about where their devices came from prior to reports of labor violations at factories run by Apple's Chinese manufacturing partner, Foxconn. Apple has taken steps to improve the situation, but the revelations of unsavory factory conditions were a reminder of the unintended costs of building popular products.



(8) **A NEW POWER STRUCTURE**

Remember when Microsoft ruled the world? What about BlackBerry or Nokia? Everything shifted after the iPhone, which sent other phone manufacturers scrambling. Their answer: Copy the iPhone, of course. Samsung and Xiaomi have built multibillion-dollar businesses drafting off of Apple. Others were too slow to react and have paid the price.



(9) **DRAMATIC ENTRANCES**

Steve Jobs famously turned new-product introductions into theatrical productions, and with the iPhone unveiling in 2007, he perfected the art of wringing maximum buzz from what are essentially press conferences. iPhone reveals are now closely watched and tightly choreographed moments—more cultural events than device announcements.



February

Change.org launches as an online hub for activists. Though petitions are initially just a small part of its mission, they will evolve into its core service—a powerful tool of persuasion.

June

MTV recruits Aziz Ansari and his fellow *Human Giant* cast members to use Twitter during the MTV Movie Awards—an early example of live-tweeting a television event. The stunt proves a success and is replicated with even more celebrities at the Video Music Awards a few months later.

With the help of seed funding from Y Combinator, Drew Houston cofounds, along with Arash Ferdowsi, the cloud-based file-sharing service Dropbox.

October

Spurning music labels and traditional distribution models, Radiohead releases its seventh album, *In Rainbows*, on its website as an MP3 file and tells fans to pay as much, or as little, as they'd like to download it.

Artwork by Marian Bantjes; Debbie Millman; Richard Baker; Claudia De Almeida; Tom Brown; Kristina DiMatteo; Rodrigo Coral; Christian Schwartz; Mirko Ilic

2008

JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC

14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000

JAN 23
Founded by Danae Ringelmann (pictured), Slava Rubin, and Eric Schell, crowdfunding pioneer Indiegogo debuts at the Sundance Film Festival.



JAN 24
The National Association of Realtors rattles investors by announcing the largest drop in single-family-home sales in 25 years.

MAR 12
Hulu launches to the public, streaming TV and movies to anyone in the U.S. with a broadband connection.

MAR 17
Concerns grow about the mounting financial crisis after JPMorgan Chase agrees to buy out a struggling Bear Stearns for just $2 a share.

APR 10
Open-source software startup GitHub moves out of beta, offering support to developers around the world.

AUG 11
Brian Chesky, Joe Gebbia, and Nathan Blecharczyk launch Airbedandbreakfast.com ahead of the Democratic National Convention in Denver.



SEP 7
The federal government takes control of troubled mortgage-finance giants Fannie Mae and Freddie Mac.

SEP 9
James Park and Eric Friedman unveil their Fitbit Tracker, expecting a couple dozen preorders. Instead, they receive thousands.





JUL 10
Apple sparks the mobile-software market with the opening of the App Store.

SEP 16
Merrill Lynch agrees to sell itself to Bank of America, while Lehman Brothers, failing to find a suitor, files for Chapter 11, becoming the largest bankruptcy in U.S. history.

SEP 17
The government rescues insurance giant AIG with an $85 billion loan.

OCT 10
The Dow Jones drops 18%, or 1,874 points, in a single week—its biggest weekly loss ever.

DEC 1
The National Bureau of Economic Research officially declares the U.S. economy in a recession.



SEP 23
HTC announces the forthcoming release of the HTC Dream, the first smartphone to use an Android operating system.



DEC 9
During a trip to Paris for the LeWeb conference, future Uber founders Garrett Camp and Travis Kalanick begin brainstorming ideas to fix San Francisco's cab problem.

WEEKLY FLUCTUATION OF DOW JONES INDUSTRIAL AVERAGE, JAN–DEC 2008

F**k the downturn

IN A DISMAL YEAR, NOT EVERYTHING WAS ABOUT LOSS.

Economic downturns can be surprisingly fertile soil. Apple, Disney, and General Motors were all born from recessions—evidence that when the economy is down, some of the most resilient ideas rise up. The same was true in 2008. Businesses closed doors and layoffs came in waves. But even as Wall Street crashed, green shoots were appearing in Silicon Valley and elsewhere, thanks to entrepreneurs who saw opportunities for innovation in the downfall. It's no coincidence that both the sharing economy and crowdfunding movement emerged that year. Here's how 2008 unfolded, from the shudders of the recession to the signs of life to come. *—JH*

July

Beats by Dre headphones become a status symbol and fashion statement—and, in 2014, an Apple acquisition.

October

Someone using the name Satoshi Nakamoto publishes a research paper online titled "Bitcoin: A Peer-to-Peer Electronic Cash System," outlining a new, decentralized cryptocurrency. Three months later, the first bitcoins are issued.

November

Senator Barack Obama triumphs over Senator John McCain with a presidential campaign strategy that uses Twitter, Facebook, and MySpace to help win over voters of all ages.

Taylor Swift releases her second album, *Fearless*. The work goes on to nab the Album of the Year Grammy, making Swift the youngest such winner and setting her up for a successful crossover from country star to pop juggernaut.

Lance Iversen/San Francisco Chronicle/Corbis (Ringelmann); Mike Kepka/San Francisco Chronicle/Corbis (Airbnb); Justin Sullivan/Getty Images (Jobs); Jonathan Sprague/Redux (Camp); Charles Eshelman/Getty Images for AOL (Kalanick)

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2009



Protesters in Tehran in 2009 hold images of Neda Agha-Soltan, who became a symbol of Iran's opposition Green Movement after her death.

Social media goes global

IT WAS THE VIDEO THAT SHOCKED US ALL—AND RALLIED THE WORLD AROUND A MOVEMENT.

Neda Agha-Soltan, only 26 years old, was shot dead on June 20, 2009. The philosophy student was on her way to watch the protests against the victory of Mahmoud Ahmadinejad in the Iranian presidential election when she was struck by a single bullet, believed to have been fired by security forces. She died surrounded by onlookers, who held her as she bled—an act that was captured by a shaking cell-phone camera and uploaded to Facebook and YouTube. The video quickly went viral on Twitter, and soon media outlets like the BBC and CNN began broadcasting versions, turning Agha-Soltan into the face of the Green Movement in Iran and drawing attention to clashes between the Iranian people and their government. Never before had citizens in crisis been able to disseminate their stories so easily to millions of strangers around the world.

Aided by hashtags such as #iranelection and #Neda, Twitter played an especially outsize role throughout the summer. As the Iranian government shut down text and cell-phone service inside the country, protesters used the still-nascent social network to communicate vital information—police activity, protest locations, and calls for medical assistance—to one another and to activists outside the country. When the service was blocked inside Iran, protesters turned to websites that helped post tweets on their behalf. And international news outlets combed through Twitter to gather eyewitness accounts of the turmoil. By the end of the year, the proportion of Twitter users outside the U.S. had increased from 38% to 49%.

Agha-Soltan's death set the stage for an era of citizen reporting and social media activism, which exploded during the Arab Spring less than two years later. Today, it's standard practice for activists from Hong Kong to Baltimore to capture and share images of every protest sign, arrest, and canister of tear gas they encounter. Along with every bullet. *—Anjali Mullany*

A BRIEF HISTORY OF TWITTER ACTIVISM

06.09

Iran's Green Movement

#iranelection #Neda // You saw the pain in her eyes. Don't let her die in vain.

HY @niphette

01.11

Tunisia's Jasmine Revolution

Tunisia is entering a critical stage in fight for freedom. This is no time to stop. No settlement only **#jasminerevolution #tunisia #sidibouzid**

Voice of Tunisia @Voiceoftunisia

02.11

Tahrir Square, Egypt

Despite the blood and the pain, spirits here are sky-high. People singing the anthem & waving flags while throwing stones. **#Jan25 #Tahrir**

Mosa'ab Elshamy @mosaaberizing

09.11

Occupy Wall Street

If you haven't heard already, the People are taking over NYC **#occupywallstreet**

Terrestria Movement @UCEarth

08.14

Ferguson, Missouri

#Ferguson residents, start uploading pictures and video, NOW.

Tammi LaTela @TLaTela

June

Global outpouring over Michael Jackson's sudden death causes Internet traffic to surge to unprecedented levels. Twitter crashes and several news outlets experience outages. Jackson is the first celebrity to break the Internet.

July

Google announces the Google Chrome Operating System, an attempt to "rethink what operating systems should be."

December

Jack Dorsey and Jim McKelvey found Square, offering retailers an easier way to accept debit- or credit-card payments. The company is one of the first to enter the mobile-payment market, which now includes Apple, Google, and Samsung.

Avatar hits theaters and smashes box-office records. The science-fiction epic, directed by James Cameron, breaks boundaries with its use of new technologies that blur the line between computer generation and live action.

Polaris

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LED | LOUISIANA ECONOMIC DEVELOPMENT

2010

How I get it done

VidCon makes a scene

THE NEW EVENT UNLEASHED A FLOURISHING GROUP OF WEB-VIDEO CREATORS.



Brothers Hank (right) and John Green are at the center of the online-video community.

The basement of a Hyatt in L.A. might not seem glamorous, but for the YouTube-video makers who gathered there for the first-ever VidCon—held over the course of three days in July 2010—it was the most exciting spot on the planet. Organized by scene-leading VlogBrothers creators John and Hank Green, the first VidCon brought together the medium's most passionate participants. Five years later, VidCon is a 21,000-person event that attracts major brands, and creators such as Grace Helbig have become mainstream stars. John (also known for writing novels such as *The Fault in Our Stars* and *Paper Towns*) and Hank reflect on the event. —*Nicole LaPorte*

What was the vibe like that first year?

HANK: It was always a big deal to me, even if it only had 1,800 people. It was across the street from [top entertainment-business talent agency] CAA, and CAA had no idea that it was happening. But to me it felt like a really important cultural thing.

Now Hollywood studios screen movies at VidCon and brands feel they need to be there. Does part of you want to protect that original spirit?

HANK: Our goal is to reflect what online video is doing. We're not going to impose our values and say, "No! Online video should be grassroots and independent!" I like that stuff, and in a lot of ways online video works best in an independent and authentic way, but it also works well in other ways.

John, you're a big-deal novelist. Do you inhabit both the mainstream and underground?

JOHN: The things that I want to do with my life are making videos and writing books. I feel really, really lucky that I get to do both. More people watched my video about why the American health care system is [so] expensive than saw *Paper Towns*. I guess health care analytics videos are less underground than Hollywood movies.

How has the maturation of the platform changed things?

HANK: Early on, no one knew what the heck was going on, which was kind of exciting but also kind of paralyzing. Now we've gone further down the path of what's possible. You can make a movie or write a book or start a video-game company or do a clothing line. Whatever you're interested in, you have this activation energy of these really lovely audiences. You can go in infinite directions.

February

Julian Assange's WikiLeaks organization releases the first of 250,000 U.S. diplomatic cables, to be followed by hundreds of thousands of documents concerning the wars in Iraq and Afghanistan.

HBO launches the streaming service HBO Go, giving cable subscribers digital access to all of its premium content. Five years later, it will untether its content from cable entirely with the stand-alone HBO Now.

April

Apple unveils the first-generation iPad tablet. In less than three months, the company sells 3 million units.

December

WeWork opens its first coworking space, in Manhattan's Soho neighborhood, with a winning combination of chic interior design and entrepreneur-friendly services. The concept—and business—takes off.

Photograph by Ryan Lowry

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◀ JOHN SANDUSKY

RUNNING LEAN



"WE QUICKLY SAW WHAT RYDER WAS ABLE TO DO—WITH THEIR EQUIPMENT, THEIR DRIVERS, THEIR NETWORK, EVERYTHING."

◀ ERIC CORD ▲

A Conversation With Eric Cord, President, Windmill Farms Nurseries, and John Sandusky, Group Logistics Manager, Ryder

Windmill Farms Nurseries, an hour's drive due east of Sarasota, is one of the largest commercial flower and plant suppliers in Florida. For a family-owned business that ships its product to home-improvement stores throughout the southeastern U.S., reliable—and affordable—fleet management is critical. But over the years, Windmill found it difficult to manage its core business while also maintaining what amounted to a transportation network.

Enter Ryder, which in 2011 began providing Windmill with trucks, drivers, and maintenance personnel. For Eric Cord, the president of Windmill Farms, the relationship with Ryder has meant not only a heightened ability to focus on the nursery's true calling—growing flowers and other plants for market—but has brought unforeseen cost savings, too.

Cord and Ryder logistics manager John Sandusky recently spoke about the ways in which a logistics company of Ryder's experience and scope can help small and medium-size businesses thrive in unexpected ways.

Eric, in the four years you've been partnering with Ryder, was there a moment when you realized that Ryder had delivered exactly what it promised?

ERIC CORD: Not long ago, a customer asked me to take on a new market. Before we partnered with Ryder, we would have faced concerns about how to even deliver our product to that market. We would have had to really look at how much it would cost to add more equipment, hire more drivers, etc. But now, I didn't hesitate to say yes, because I knew we had Ryder's assets to help out. Being able to say yes, with confidence—that's a big deal for us.

How difficult was it to give up control of that core portion of your business—the transporting of your goods—to an outside enterprise?

EC: At the start, we didn't know what Ryder was capable of. Our business has been built on our ability to deliver product in a timely manner, and we didn't want to lose that momentum. But we quickly saw what Ryder was able to do—with their equipment, their drivers, their network, everything. It became very clear that contracting out that central aspect of our business was certainly the right choice. I'm glad we did it.

John, as a manager at Ryder, what's the single most transformative innovation you've seen during your time in the shipping and logistics business?

JOHN SANDUSKY: It may come as a surprise, but it involves safety, which is a sector where Ryder's long been an innovator. We've taken an industry that looked at safety as almost an afterthought and we've ingrained it into our culture. In fact, in pretty much every metric of safety performance, we lead the industry. Knowing they're going to work for a safety-first company allows us to attract and retain the best drivers. That consistency and quality in our drivers has a direct impact on the sort of service we provide to partners like Windmill.

Eric, how central to Windmill's mission is sustainability—alternative fuels, recycling, energy-efficient trucks—and how has Ryder been able to help in that regard?

EC: With Ryder carrying the burden on the trucking side, we're freed up to concentrate on sustainability and renewable energy sources for the farm itself. Implementing a water-collection system, scouting for bugs before we actually spray insecticides, recycling all of our plant trays—there are a lot of things we're doing to avoid wasting both resources and money. But we're also talking with Ryder about designing specialized trailers that are, in effect, shaped for our racks. That would make far more efficient use of space and fuel, and could increase each load by as much as 12%. It's the sort of thing where doing well goes hand in hand with doing the right thing.

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2011

Google shoots for the moon

LARRY PAGE SET OUT TO PROVE THAT THE FUTURE IS SHAPED BY BIG BETS.

When Google cofounder Larry Page returned to the company as CEO in 2011—after relinquishing the role to tech-industry veteran Eric Schmidt a decade earlier—he focused the sprawling organization on launching projects Google calls moonshots: efforts that strive to change the world by being 10 times better than anything that has come before. The company operates two research arms devoted to such efforts, Google X (which Page helped form) and Advanced Technology and Projects. Today, Google is reengineering the entire company around these otherworldly endeavors, turning core products, such as its search engine, into merely a division of a corporate parent called Alphabet Inc. Six of the following projects are real moonshots being pursued by Alphabet/Google. Three of them, we made up. Can you tell which are which? *—HM*



1

THE QUEST TO CONQUER DEATH

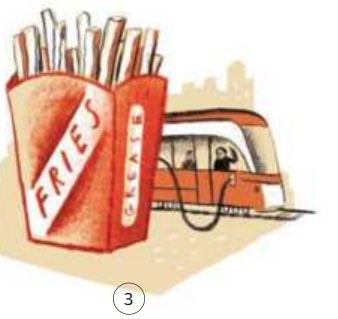
Calico, a joint venture with Art Levinson, former CEO of biotech giant Genentech, is dedicated to extending the human life span, collaborating with Harvard and MIT to develop treatments for cancer and heart disease.



2

DRONES THAT SAVE LIVES

In Australia, Project Wing has been testing autonomous aircraft—with four propellers and a five-foot wingspan—that could be used to swiftly deliver supplies in emergencies such as earthquakes and floods.



3

GREASE-POWERED STREETCARS

Project Clang is engineering a public-transportation system with ultralight railcars that run on biodiesel fuel derived from oil used to cook foodstuffs such as french fries.



4

FLYING WINDMILLS

Makani Power, which is part of Google X, designs "energy kites"—a type of highly efficient, airborne wind turbine that flies in circles, producing power that is sent down to the ground via a tethered cable.



5

SNAP-TOGETHER SMARTPHONES

Project Ara lets consumers assemble a smartphone from magnetic tiles containing chips and sensors—a cheaper way for people in developing economies to upgrade their devices.



6

MUSIC THAT (REALLY) MAKES YOU SMARTER

A joint venture with the L.A. Philharmonic, Batonix designs musical instruments that produce sound at frequencies that stimulate the cerebral cortex and increase IQ.



7

HEALTH-MINDED CONTACTS

Former University of Washington researchers at Google X are developing contact lenses with embedded circuitry, sensors, and LED indicators, so that diabetics can keep tabs on their glucose levels throughout the day.



8

YOUR OWN PRIVATE IKEA

Alphabet has staffed up with veterans of the 3-D–printing industry to develop a refrigerator-size gadget that can produce furniture, with the goal of generating a coffee table from recycled polyurethane in less than 24 hours.



9

CARS THAT KNOW THE ROAD

Using cameras, lasers, radar, and a lot of extremely sophisticated software, Alphabet is teaching cars to drive themselves, with the aim of combating the 1.2 million deaths worldwide caused by auto accidents each year.

May

Bridesmaids, produced by Judd Apatow and cowritten by and starring Kristen Wiig, is a surprise blockbuster, grossing $288 million and confirming the box-office viability of female-driven comedy.

September

A year after Instagram launches, Oscar de la Renta and other brands turn to the photo-sharing service to offer behind-the-scenes peeks of New York Fashion Week. A beautiful relationship is born.

October

The Nest Learning Thermostat—with its behavior-tracking technology—becomes the first high-profile Internet of Things device and later, a lucrative Google acquisition.

December

BuzzFeed hires *Politico*'s Ben Smith to run its new journalism unit, expanding its repertoire to investigative features and breaking news (in addition to cat videos).

Key: 1, 2, 4, 5, 7, and 9 are real moonshots.

Illustrations by Peter Oumanski

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REDESIGNING WORK
IN AN ERA OF COGNITIVE TECHNOLOGIES

Cognitive technologies—technologies grounded in artificial intelligence research—are mechanizing tasks once reserved for even highly skilled workers, and putting greater pressure on companies to rethink their workforce.

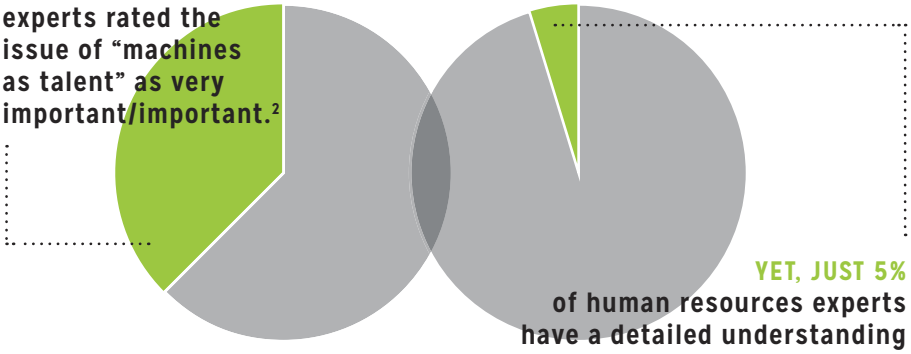
THE WORKFORCE IS CHANGING



NEARLY HALF of total U.S. employment could be automated over the next two decades.[1]

FEW LEADERS ARE READY

6 OUT OF 10
human resources experts rated the issue of "machines as talent" as very important/important.[2]



YET, JUST 5%
of human resources experts have a detailed understanding of how cognitive technologies will impact their workforce.[2]

Cognitive technologies confer a competitive advantage, but not just by eliminating jobs; when blended with human intelligence, AI delivers greater value.

GET IN FRONT

Cognitive technologies are poised to transform the workforce. Business leaders need to get ahead of the trend by considering several approaches to implementing such technologies:[3]

01 REPLACE — Using technology to perform a human job

02 ATOMIZE/AUTOMATE — Segmenting and automating tasks, leaving humans to supervise

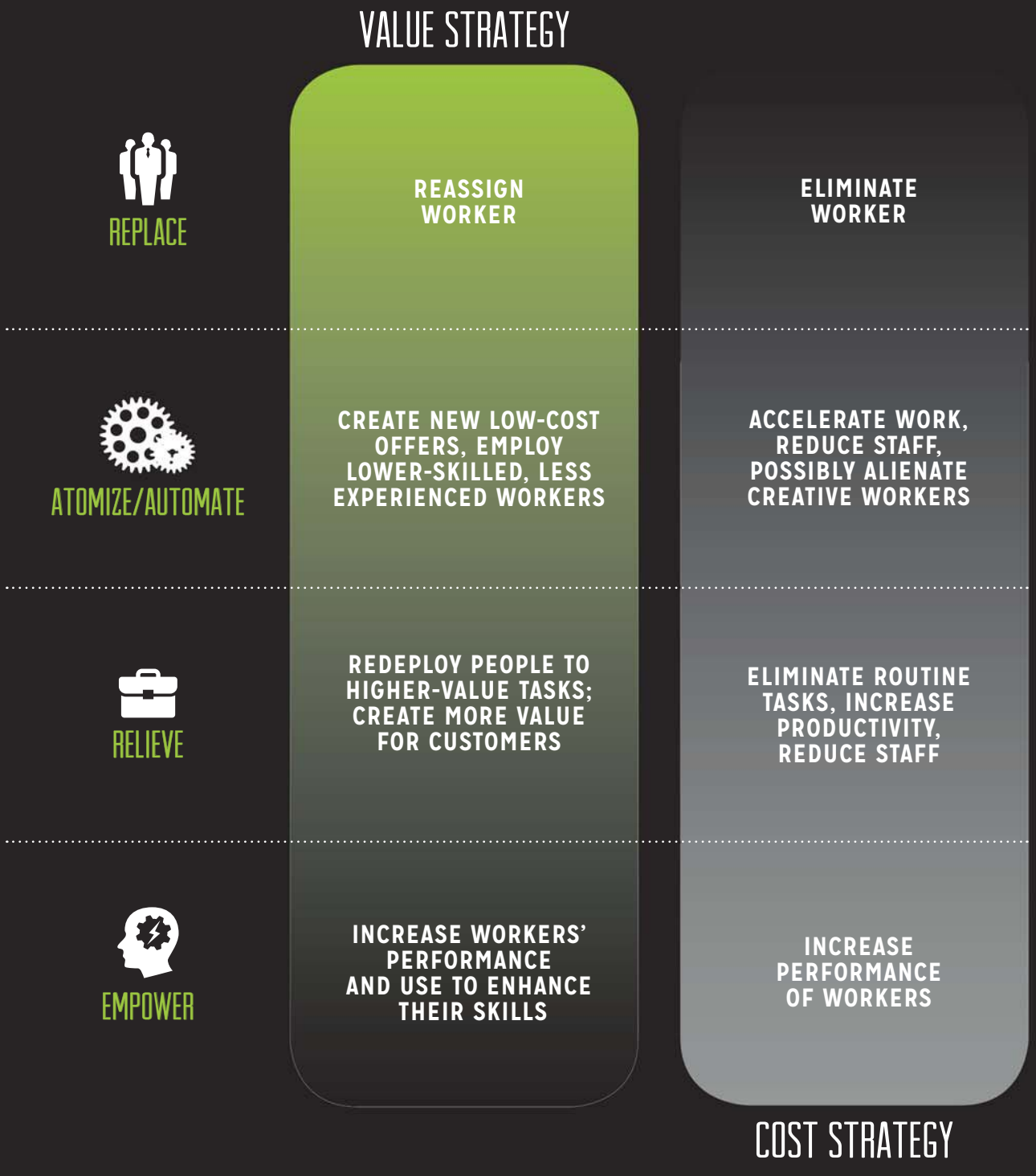
03 RELIEVE — Using technology to take over grunt work so complex thinking falls to workers

04 EMPOWER — Using technology to optimize human decision-making

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IDENTIFYING STRATEGY

When implementing cognitive technologies or automation technologies, businesses must make a careful choice between ADDING VALUE and CUTTING COSTS.[3]



Sources: 1. Carl Benedikt Frey and Michael A. Osborne, *The future of employment: How susceptible are jobs to computerisation?*, Oxford Martin School, University of Oxford, September 17, 2013. 2. Deloitte's 2015 Global Human Capital trends report. 3. David Schatsky and Jeff Schwartz, Redesigning work in an era of cognitive technologies, Deloitte Review, 2015.

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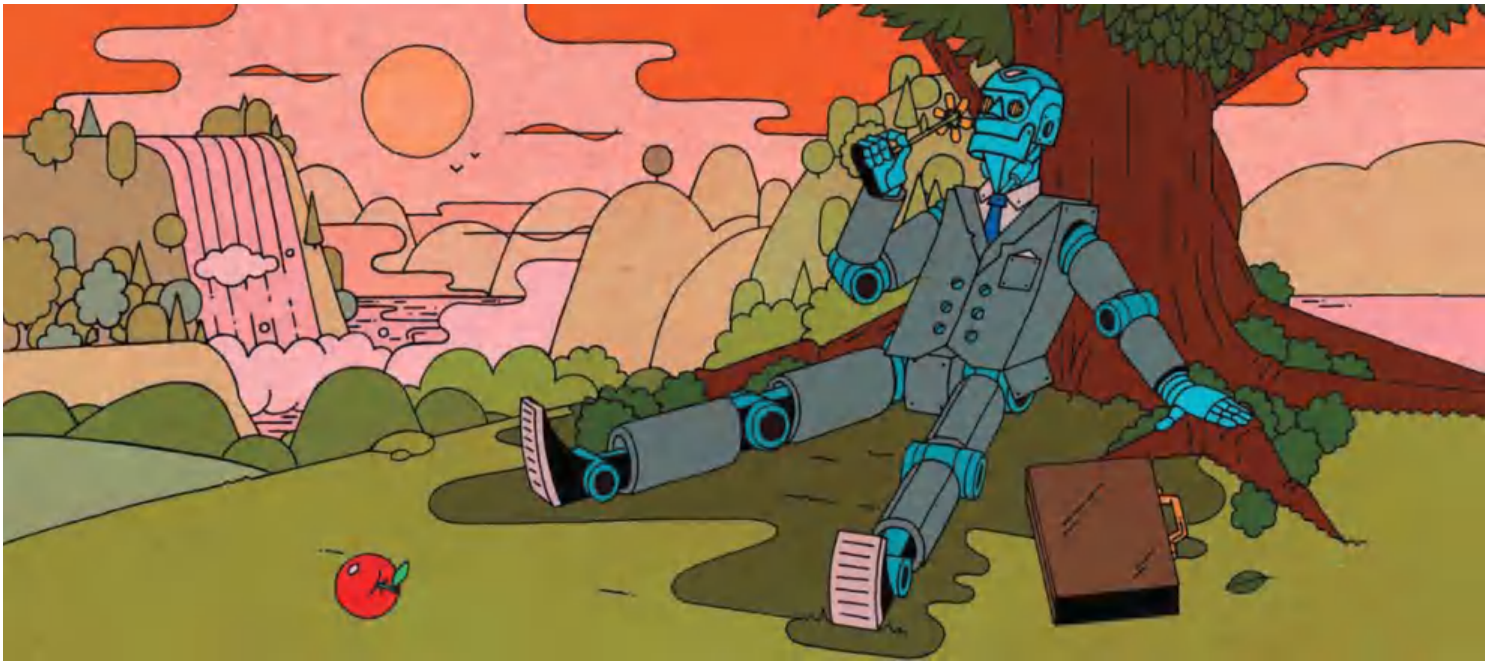
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Social good

Dawn of the do-gooders

IN THE WAKE OF THE GREAT RECESSION, A NEW KIND OF COMPANY GAINED TRACTION.

Businesses focused on social good have been around for decades, but the concept really took off in 2012, as new laws in several states—including the startup-friendly California and New York—allowed mission-based companies to reincorporate as benefit corporations and protect themselves from shareholders who might not prioritize values such as employee wellness or eco-friendliness. One of the biggest proponents of this regulation was B Lab, a not-for-profit that offers its own nonlegal framework for such companies, certifying them as B Corporations. According to cofounder Jay Coen Gilbert, the same unrest that fueled the Occupy movement of 2011 helped propel social enterprises mainstream. "It was clear that the interests of business and society were no longer aligned," he says. Today, there are more than 3,000 benefit corporations and more than 1,400 Certified B Corporations.
—Kenrya Rankin

The model citizen

Patagonia

When Patagonia, the Ventura, California–based outdoor clothier, registered as the state's first benefit corporation in January 2012, it helped accelerate the crusade across the U.S. (By August, 100 companies had registered in multiple states.) "It reflects the way we work and what defines and brings us success," says president and CEO Rose Marcario. Patagonia gives 1% of sales to green organizations, closely monitors conditions in partner factories, and uses eco-friendly materials in 75% of its products. "They're a rock star of the new economy, and people want to be like rock stars," B Lab's Gilbert says.

Certified superstars

Etsy

In April 2015, crafty e-tailer Etsy became the second Certified B Corporation to go public (after IT startup Rally Software). The company—which pays employees for volunteer hours and donates to projects that train women and minorities to code—recently came under fire for maintaining an Irish subsidiary that critics have called a strategic tax haven.

Kickstarter

Kickstarter has helped nearly 10 million people raise $2 billion to fund their creative projects. As both a Certified B Corporation and a newly crowned benefit corporation (it announced reincorporation in September), Kickstarter also donates 5% of its annual posttax profits to arts education and organizations that fight systemic inequality.

Warby Parker

Selling its own stylish $95 specs made Warby Parker a force. Giving away a pair with each purchase to someone in need made it a Certified B Corporation committed to doing well by doing good. Its success shows the marketing potential of building social goals into a for-profit model.

January

More than 100,000 websites, including Wikipedia and Reddit, protest two antipiracy bills in Congress that would let the government broadly monitor the Internet. The 24-hour blackout has swift effect: Two days later, both bills are shelved indefinitely.

April

Facebook announces that it will buy Instagram for $1 billion. The price tag shocks Silicon Valley but later proves to be a steal.

June

Microsoft reveals a new tablet computer, the Surface; it's the first PC Microsoft has ever produced and sold itself, showing a renewed determination to head off competition from Apple.

October

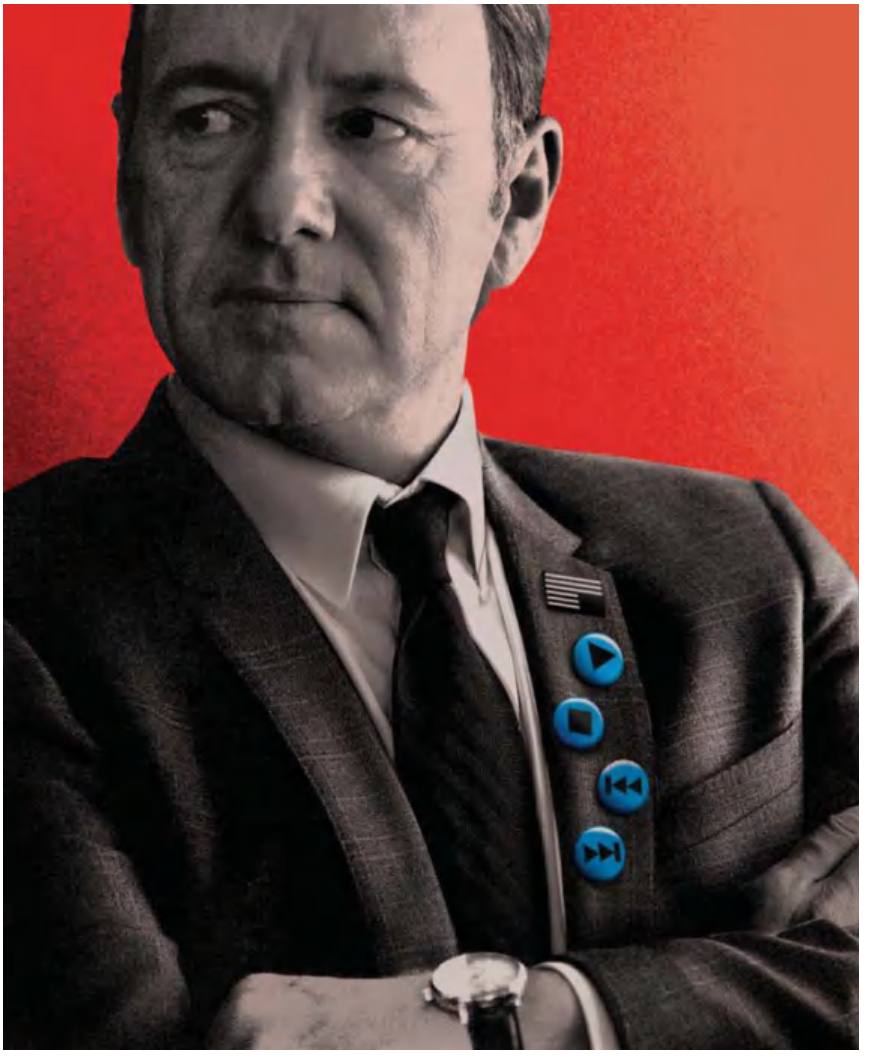
Felix Baumgartner becomes the first person to break the sound barrier (unaided by transport) during a free-fall jump from the stratosphere. The dive is sponsored by Red Bull and live-streamed on YouTube, where more than 8 million viewers tune in to watch.

Illustration by Stefan Glerum

2013

The triumph of content

WITH *HOUSE OF CARDS*, NETFLIX TRANSFORMED HOW TELEVISION IS MADE AND HOW WE CONSUME IT.



The most shocking thing about the 2013 launch of Netflix's *House of Cards* wasn't Frank Underwood's shady political dealings—it was the way the show shattered the traditional television model. "Netflix was the first to recognize and exploit evolving consumption behaviors," says Liam Boluk, a media-strategy consultant at Redef. Here are four ways the Kevin Spacey drama has forged a new approach to TV. —*NP*

1

Who needs a pilot?

TV production typically involves commissioning a test pilot episode before committing. Executives have long groaned about the inefficiency—and cost—of making dozens of pilots, only to see a fraction wind up on TV. Netflix paid a whopping $100 million up front for two seasons of *House of Cards*—before seeing a minute of footage. Six Emmys and dozens of nominations later, it's safe to say the gamble worked.

2

Creators first

Cards was the brainchild of director David Fincher (*Gone Girl*), and Netflix approached it like a film, giving the creators unusual control. This artist-first mentality was further enabled by Netflix's interest in quality and buzz over ratings. "Art is best handled by the artist," says Netflix's chief content officer, Ted Sarandos. "Let them realize their vision. Win, lose, or draw, it happens on the merit of the programming, not on the perceived instincts of a TV executive."

3

Binge away!

Netflix launched all 13 first-season episodes at once, and fans gobbled them up in marathon sessions. The ensuing reaction turned the show into a phenomenon literally overnight. The strategy also allowed for a richer narrative, since story arcs no longer had to be neatly resolved at the end of each installment. "This was crafted to be watched in multiple episodes or possibly all at once," says Sarandos. "It had to hold up to a different level of continuity and logic scrutiny, which is one of the things that makes the show so strong."

4

It's a numbers game

Netflix pays careful attention to viewer data. The company has created algorithms to help decide whether to green-light shows (Spacey and Fincher were both popular on the service). Big data even informed the way Netflix promoted *Cards*. Subscribers received different trailers based on their viewing habits: Political junkies saw more of Spacey, while women got more of his wife (Robin Wright). Since then, Netflix has used its data expertise to create and promote other series, such as *Orange Is the New Black*.

March

Less than a year after *The Atlantic* publishes Anne-Marie Slaughter's "Why Women Still Can't Have It All" treatise on the myth of work-life balance for women, Facebook COO Sheryl Sandberg calls on professional women to embrace their ambition in her best seller, *Lean In*.

June

As their user bases reach the millions, Snapchat and Tinder spark sexting and hookup worries among some parents.

Edward Snowden hands over thousands of classified documents concerning the National Security Agency to journalists.

July

The #BlackLivesMatter hashtag first appears, in response to the acquittal of George Zimmerman in the death of 17-year-old Trayvon Martin in Sanford, Florida. "We've connected people across the country working to end the various forms of injustice impacting our people," writes movement cofounder Alicia Garza.

Source image: Nathaniel Bell for Netflix

Illustration by Doug Chayka



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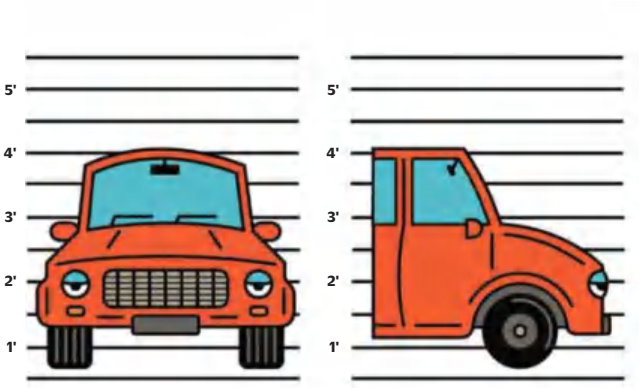
2014

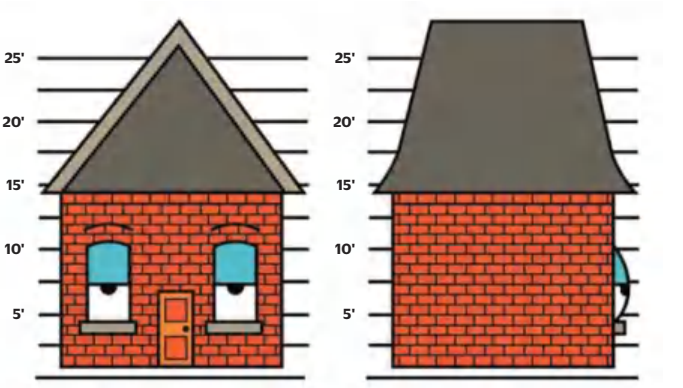
Face-off

Disrupters in the crosshairs

THE BATTLE BETWEEN INNOVATION AND REGULATION REACHED FEVER PITCH.

The "move fast and break things" philosophy of innovation gets messy when one of the things you're breaking is the law. In 2014, some of the most promising companies hit their first major roadblocks with regulation, among them Airbnb and Uber, each of which went head-to-head with city leaders. How they approached and resolved their regulatory battles spoke volumes—and still does, as their legal scuffles continue. —*Sarah Kessler*





	UBER	AIRBNB
1 THE SCENARIO	Facing lawsuits and bans from South Korea and France for flouting transportation rules, **Uber doubled down on a destination closer to home:** Portland, Oregon. Many of the towns surrounding the city had already embraced the car-sharing app, but Portland Mayor Charlie Hales had been hesitant until working out an agreement with the service.	Airbnb's passive-aggressive **skirting of San Francisco's laws banning short-term rentals** and requiring a 14% tax on hotel rooms finally caught up to the six-year-old startup. David Chiu, president of the city's Board of Supervisors, announced that San Francisco had about 100,000 short-term-rental violations a year—and the city had begun cracking down.
2 THE CONFLICT	In July 2014, Uber posted a taunting blog entry titled "Hey Portland, We Are Just Across the River." Five months later, without the mayor's blessing—or knowledge—Uber launched its Portland service and even threw a party, which included a spot to take photos with protest signs and create postcards to mail to Hales. **Portland sued Uber** shortly after, with Hales asserting that "no one is above the law."	With the City Planning Department threatening fines for illegal rentals and landlords evicting hosts for violating leases, **Airbnb was squeezed in its hometown.** Publicly, it offered little support to its embattled hosts, advising them to find lawyers. Behind the scenes, it petitioned Chiu to craft a more accommodating law and agreed to pay outstanding hotel taxes, estimated at $12 million annually.
3 THE RESOLUTION	Despite Hales's resistance, Uber effectively forced Portland's hand. **The two sides struck a deal** later in December that put the lawsuit on hold and suspended Uber's service for several months while a task force figured out a new set of rules. The task force eventually suggested a trial period for Uber, which the city has since extended.	Officials became more open to compromise. **In October, the Board of Supervisors passed the "Airbnb law"** to allow short-term rentals (with restrictions). Though Airbnb's San Fran conflicts aren't over—it's spent $8 million fighting an initiative that would limit how long hosts can rent out their homes—the law legalized its business in the city.

January

Mary Barra becomes the first female CEO of a global automaker when she takes over General Motors.

May

Google is among the first of several companies to reveal its dismal workplace diversity numbers, fueling the ongoing debate about Silicon Valley's largely white, male workforce. Despite the figures, several companies and organizations launch crucial initiatives to improve gender and racial diversity in tech.

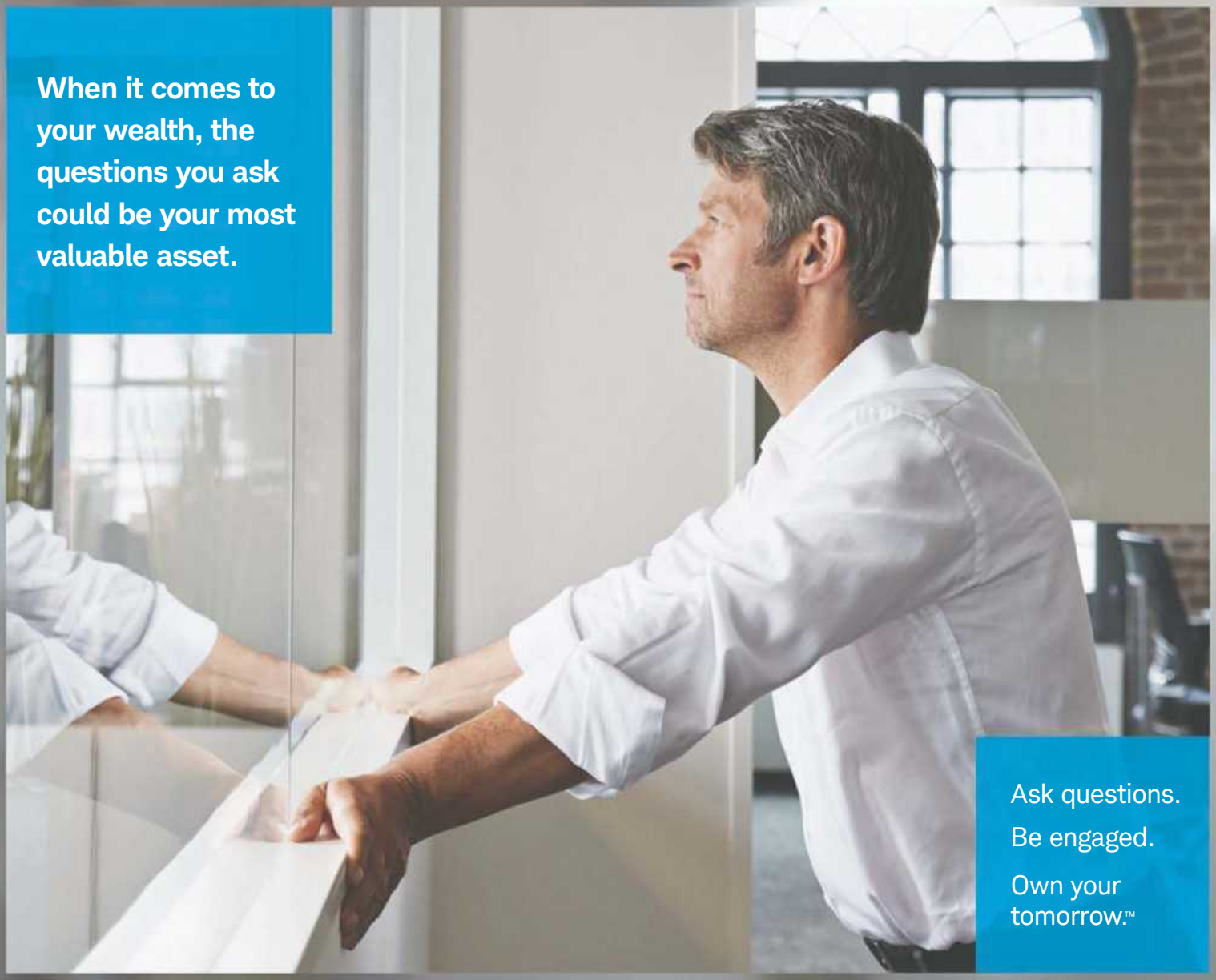
October

Reexamining the 1999 murder of a Maryland teen, the *Serial* podcast launches, hitting 5 million iTunes downloads in record time. It later wins a Peabody Award and helps ignite the "Podcast Renaissance."

November

Sony experiences a massive system breach in which hackers leak private emails, employee data, and unreleased films. The attack leads Sony to pull *The Interview* from theaters and President Obama to issue sanctions against the suspect, North Korea.

Illustrations by Serge Seidlitz



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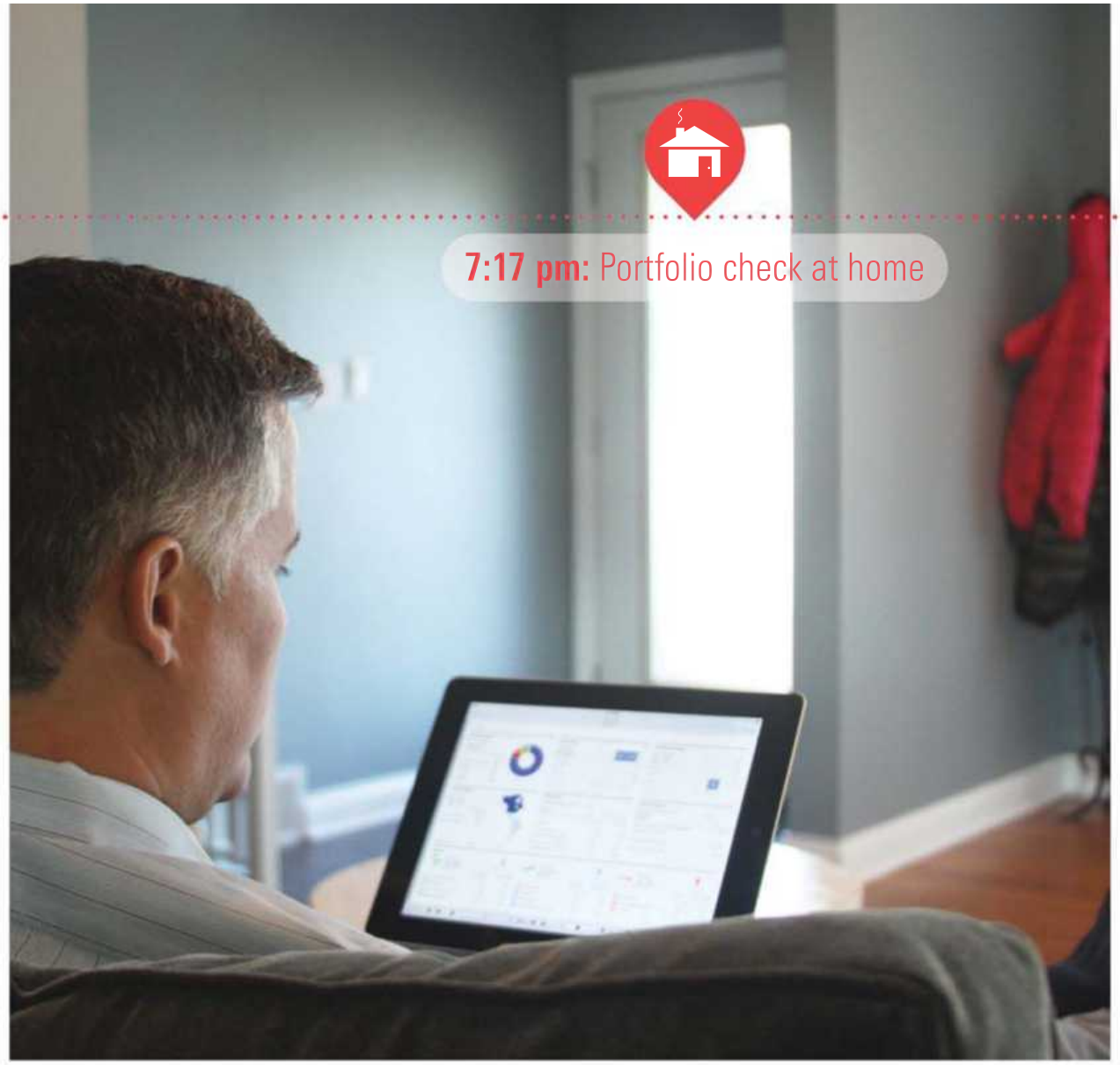
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Can innovation save the world?

THE UNITED NATIONS SET THE BAR FOR THE NEXT 15 YEARS—AND IT'S A HIGH ONE.

There is something at once awe-inspiring and a little overwhelming about the UN's latest effort to end poverty and improve the lives of the disadvantaged around the planet. Adopted in September, the organization's Sustainable Development Goals (SDGs) are an exhaustive agenda covering everything from gender equality and education to climate change and hunger. They're a sequel of sorts to the Millennium Development Goals launched in 2000. That initiative, fueled in part by a booming China, made great strides in some areas (maternal health, malaria prevention) while falling short in others (climate change, gender inequality). So why have more faith in this round? For one thing, the private sector is getting more involved. Kathy Calvin, president and chief executive officer of the United Nations Foundation, talks about the role of innovation and entrepreneurship in meeting these goals. *—Darrell Hartman*

What makes the SDGs different from their predecessors? The previous goals were about ending poverty; these are about moving to prosperity. It's a totally different mind-set. And I really think the SDGs are a turning point because they call on all sectors—the private sector in particular and entrepreneurs in *double* particular—in coming up with solutions. The door is open to them in a way that it never was before.

Where are the solutions coming from? It's not just government aid or Silicon Valley. They're actually being developed in places like Ethiopia. [People are] solving problems at the ground level, like finding a better way to deliver medicine. They're really getting at where the hurdles have been for reaching scale. We just need to recognize them, get them some partnership, and start moving.

Where does tech come in? Mobile phones are a great example. This is a tool that's in people's hands already. The question is, how do you take something that is in the field and empower it further? You're using it to deliver reproductive-health messaging for moms, to check on crop pricing, to remind people to take their meds. There are great uses that enable the kind of progress we want to see. Another big problem is that data is old and cold. In gender, for example, we've identified 28 areas where data is either out of date, inadequate, not even asked for. But the private sector, which has known how to use data for a long time, is showing us ways to be creative about it. For example, students are now reporting when teachers are not showing up to schools, which has been a massive problem.

So what's the relationship between the public and private sectors? I think one of the hallmarks of this era will be a fluidity between them. The whole notion that companies have the market cornered on smart, efficient operations and nonprofits on caring about a community is old-fashioned. Both have to have both.

January

The U.S. government begins loosening its Cuba trade and travel restrictions. Airbnb is quick to launch its service on the island, and travel companies like United Airlines and Carnival soon announce intentions to follow suit.

April

The Apple Watch is released, marking the company's first major foray into wearable technology. Though the gadget receives mixed reviews, it generates enough buzz (and sales) to signal a strong future for wearables.

August

Google announces that it is reorganizing into a holding company, Alphabet Inc., that separates its more adventurous initiatives from its lucrative search and advertising business (still called Google).

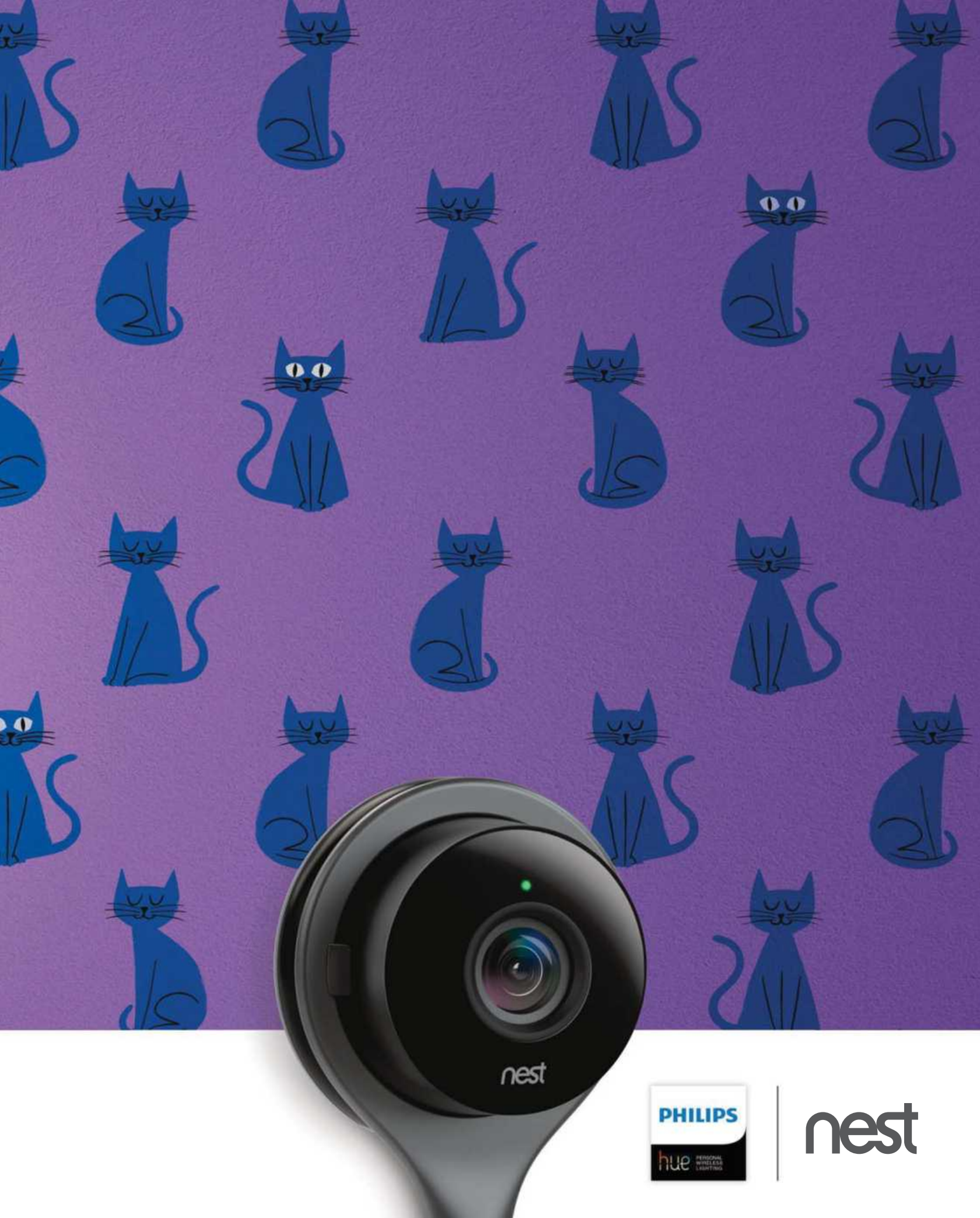
September

Pope Francis brings the Catholic Church into the 21st century. During a weeklong visit to Cuba and the U.S., he addresses climate change, dominates social media, and is greeted with rock concert–level crowds.

Illustration by Happy Lovers Town



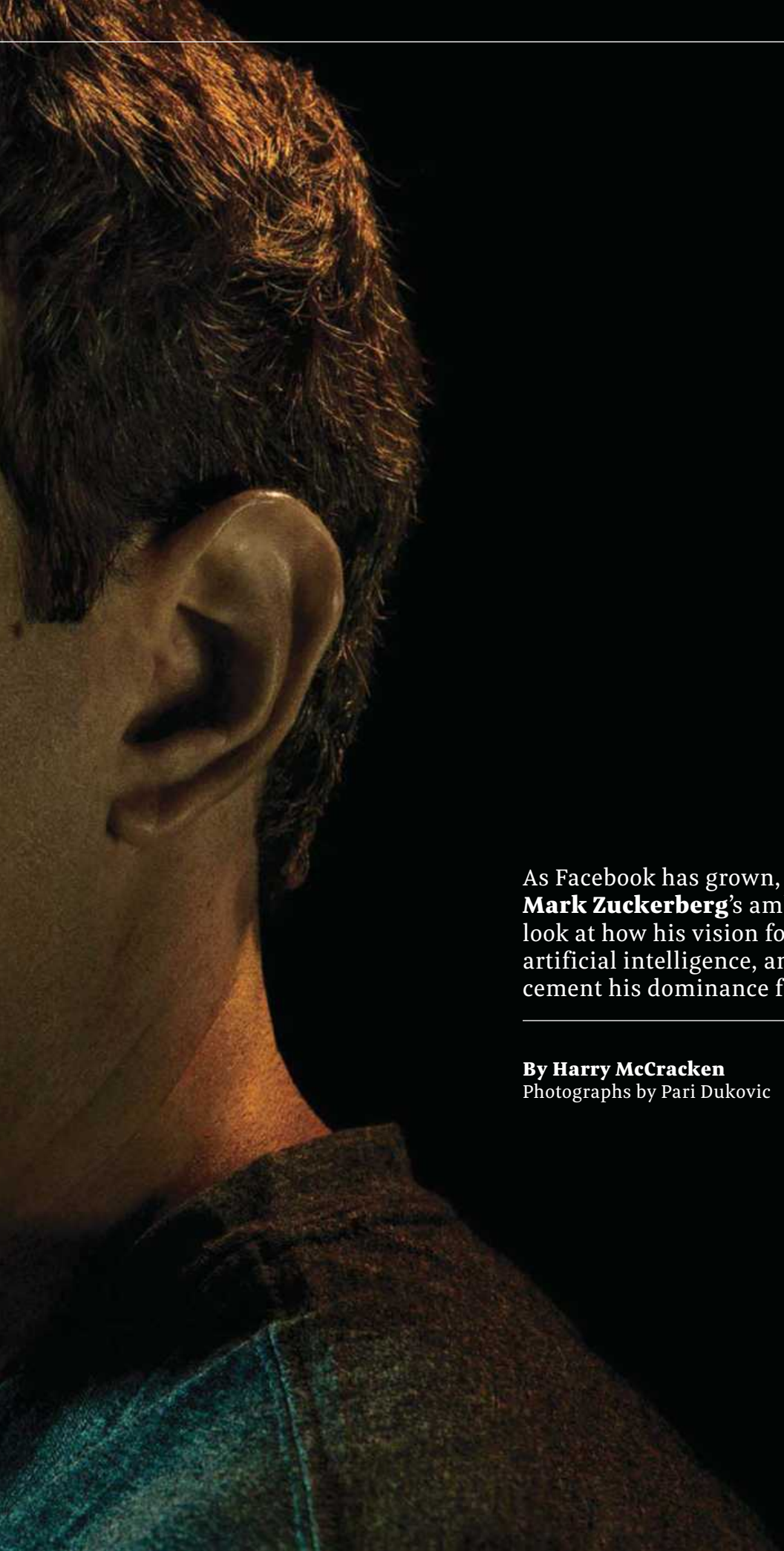
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“These things can’t fail”





As Facebook has grown, so too have CEO **Mark Zuckerberg**'s ambitions. An inside look at how his vision for virtual reality, artificial intelligence, and drones will cement his dominance for the next decade.

By Harry McCracken
Photographs by Pari Dukovic

M

"Mark is fixing stuff."

I'm killing time in the Frank Gehry–designed Building 20, whose signature feature is its soaring 434,000 square feet of open space, the latest addition to Facebook's campus in Menlo Park, California. A PR handler is explaining why CEO Mark Zuckerberg is running slightly behind schedule for our chat. I express surprise. Mark still fixes stuff?

"To say he's actively involved," she confides, "is an understatement. He notices things that are broken before anybody."

As recently as 2012, the year Zuckerberg set a personal goal to code every day, that might have meant he had detected something glitchy on Facebook's site and was reprogramming it himself. When he emerges a few minutes later, unspecified stuff presumably fixed, we sit down on adjacent couches in a fishbowl conference room near his desk in Building 20, and Zuckerberg makes it clear that those days are gone.

"If we're trying to build a world-class News Feed, and a world-class messaging product, and a world-class search product, and a world-class ad system, and invent virtual reality, and build drones, I can't write every line of code," he tells me. "I can't write *any* lines of code."

The Facebook of today—and tomorrow—is far more expansive than it was just a few years ago. It's easy to forget that when the company filed to go public on February 1, 2012, it was just a single website and an app that the experts weren't sure could ever be profitable. Now, "almost a billion and a half people use the main, core Facebook service, and that's growing. But 900 million people use WhatsApp, and that's an important part of the whole ecosystem now," Zuckerberg says. "Four hundred million people use Instagram, 700 million people use Messenger, and 700 million people use Groups. Increasingly, we're just going to go more and more in this direction."

To further grow these services and any others that Facebook develops or acquires, Zuckerberg is betting his company's future on three major technology initiatives. One is developing advanced artificial intelligence that can help Facebook understand what matters to users. The second is virtual reality, in the form of Oculus VR, the groundbreaking company that Facebook acquired in March 2014 for $2 billion, which Zuckerberg believes will be the next major technology we use to interact with each other. And the third is bringing the Internet, including Facebook, of course, to the 4 billion–plus humans who aren't yet connected, even if it requires flying a drone over a village and beaming data down via laser. Given the robust health of Facebook's business, Zuckerberg is comfortable lavishing attention and resources on these visions. Facebook gave *Fast Company* wide-ranging access to Zuckerberg, his senior leadership team, and others to delve into the company's audacious plans to shape the next decade.

In the tech industry, there's nothing weird about setting goals so lofty that they sound unachievable. Google CEO Larry Page, for instance, is so

MARK ZUCKERBERG'S GROWTH CHART

Facebook's CEO has worked hard at improving himself—and it's paid off for the business.



2009

PERSONAL CHALLENGE

Wear a tie every day.

COMPANY MILESTONE

Facebook is taken more seriously by advertisers and becomes cash-flow positive a year ahead of schedule, transforming it from startup to long-term comer.



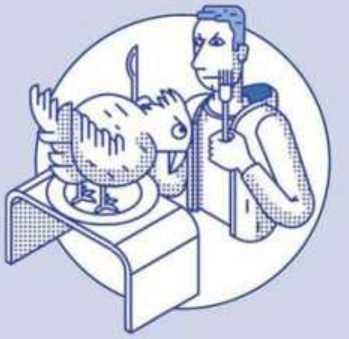
2010

PERSONAL CHALLENGE

Learn Mandarin.

COMPANY MILESTONE

Although Facebook isn't available in China, the service exceeds 500 million monthly active users, becoming the world's largest social network.



2011

PERSONAL CHALLENGE

Only eat animals he kills himself.

COMPANY MILESTONE

Acquired more than 10 startups. Moved company headquarters to the former home of Sun Microsystems in Menlo Park, on a large, centralized campus.



2012

PERSONAL CHALLENGE

Code every day.

COMPANY MILESTONE

Facebook's IPO values the company at $104 billion, a record for a new listing, though a software glitch slightly marred the debut. Purchases Instagram.



2013

PERSONAL CHALLENGE

Meet a new person every day who doesn't work at Facebook.

COMPANY MILESTONE

Launches Internet.org, in partnership with other tech companies, with the goal of making Internet access available to the entire world population.



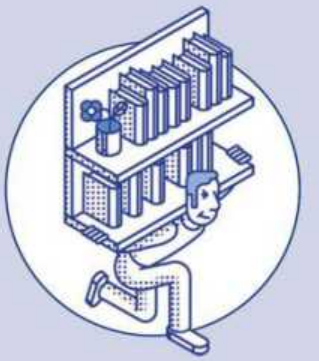
2014

PERSONAL CHALLENGE

Write at least one thank-you note every day.

COMPANY MILESTONE

Among the cards Zuckerberg might have sent: to Jan Koum, for selling him WhatsApp for $22 billion, and to Palmer Luckey, for selling him Oculus VR for $2 billion.



2015

PERSONAL CHALLENGE

Read a new book every two weeks.

COMPANY MILESTONE

Facebook expands its platform as a publisher, introducing Instant Articles and accelerating its video initiatives. It also begins to seed Oculus with content.

Illustrations by relajaelcoco

invested in the virtue of gambling on disparate, wildly ambitious projects—from self-driving cars to smart contact lenses—that he restructured his company around the concept in August, making Google's core businesses a division of a new idea factory called Alphabet. Zuckerberg, by contrast, isn't interested in doing everything—just the things he views as deeply related to his company's central vision, and crucial to it. "There are different ways to do innovation," he says, drawing a stark contrast without ever mentioning Page, Google, or Alphabet. "You can plant a lot of seeds, not be committed to any particular one of them, but just see what grows. And this really isn't how we've approached this. We go mission-first, then focus on the pieces we need and go deep on them, and be committed to them." Facebook's mission is "to give everyone in the world the power to share and make the world more open and connected," as Zuckerberg says, explaining that he is now spending a third of his time overseeing these future initiatives. "These things can't fail. We need to get them to work in order to achieve the mission."

When Facebook was morphing from Ivy League college project to Silicon Valley startup, Zuckerberg had not only "never run a company—he'd never been in a company," marvels Marc Andreessen, the browser pioneer, venture capitalist, Facebook board member, and longtime Zuckerberg confidant. "He's learned everything he knows about business in the last 10 years. And now he's one of the best CEOs in the world."

Whether because Zuckerberg, 31, started so young, or because he retains his youthful demeanor and gray-T-shirt work uniform, he has been underestimated for almost as long as his company has existed. *Facebook wouldn't work outside Harvard. It wouldn't work outside elite colleges. It wouldn't work among the general populace. It couldn't topple MySpace. It couldn't make enough money to justify its valuation. It couldn't hold on to teenagers once their parents signed up. It wouldn't matter as much on smartphones as it had on PCs. It couldn't make enough money on mobile to satisfy Wall Street.*

Zuckerberg and his team have overcome every doubt. Almost 90% of the nearly 1.5 billion people a month who use Facebook access it on a mobile device at least part of the time, and more than three-quarters of

HOW ZUCK USES FACEBOOK

Mark Zuckerberg has been using his own creation longer than anyone. Today, his posts give insight into his interests and activities—and no matter the subject, Facebook's mission of making the world more open and connected always seems to be top of mind.

HE'S STATESMANLIKE

140,140 likes



If you see a photo of Zuckerberg in a suit and tie, the odds are high that he's meeting with an international dignitary. In September, he hosted Indian Prime Minister Narendra Modi for a town-hall forum on Facebook's campus. Modi endorsed the power of social media to keep government accountable.

HE'S HUMAN

1,767,632 likes



On July 31, Zuckerberg posted that his wife, Priscilla Chan, was expecting a baby girl after three miscarriages: "You feel so hopeful when you learn you're going to have a child. You start imagining who they'll become and dreaming of hopes for their future. You start making plans, and then they're gone."

HE TAKES STANCES

291,731 likes



When the U.S. Supreme Court legalized same-sex marriage, Zuckerberg posted a graphic showing the growth in Facebook LGBT groups since 2008. "Our country was founded on the promise that all people are created equal, and today we took another step toward achieving that promise."

HE CELEBRATES SUCCESS

60,997 likes



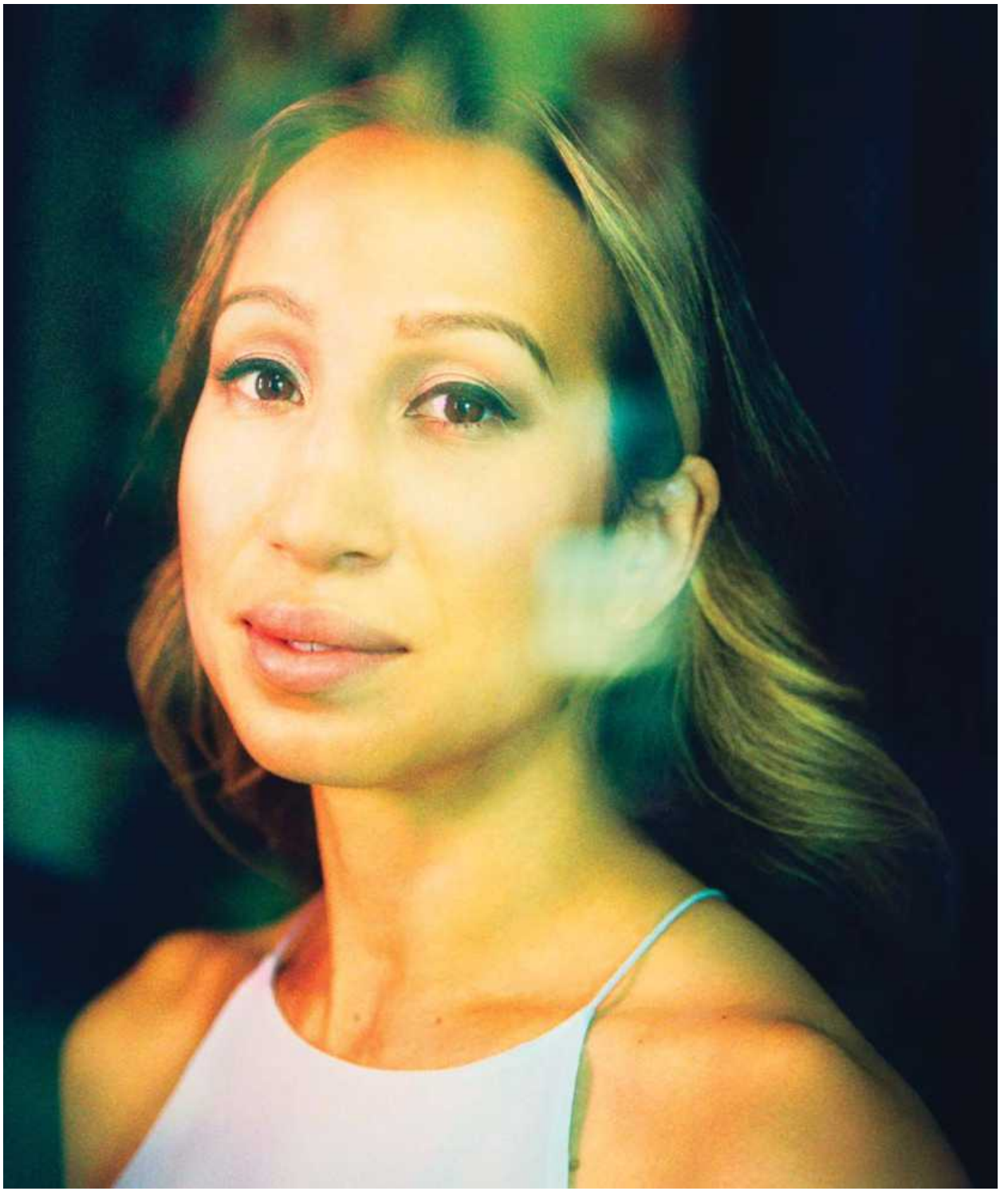
"Our community reached a nice milestone today," Zuckerberg wrote in February. More than 2 million small businesses were buying ads on Facebook—which he said was good for those companies, their customers, and the economy. Left unstated: It's also very good for Facebook.

HE'S PLAYFUL

991,333 likes



In April, Zuckerberg donned sunglasses to pose with action star Vin Diesel, who dropped by Facebook to talk about what it's like to have 87 million followers. He was stoked—"I'm looking forward to seeing *Fast & Furious 7* tonight!"—and noted that Diesel writes all his own Facebook posts.



Naomi Gleit
VP, Product, Social Good

"We are taking a data-driven, product-driven approach to doing good in the world. You're interested in certain causes, and you're also interested in the causes that your friends are interested in, so we're trying to take a social angle."

its $3.8 billion in advertising revenue in the second quarter of 2015 came from mobile users. The company runs four of the six largest social platforms in the world (all but Google's YouTube and Tencent's WeChat) and is wildly profitable. Three years ago, when the company revealed that 1 billion people logged in to the service in one month, the news was astounding. Last August, 1 billion people used Facebook on a single Monday, and it felt inevitable.

When I ask people close to Zuckerberg how, exactly, he has pulled off these achievements, I don't hear a lot of anecdotes about him swooping in and personally making genius-level decisions that suddenly changed everything. Instead, they praise his inquisitiveness, persistence, ability to deploy resources, and devotion to improving Facebook and himself. He has a knack for carving up grand plans into small, doable victories. "Most of our conversation was about long-term strategy, and then we'd backtrack from there to what we should do over the next month," says Bret Taylor, who worked as Facebook's CTO from 2009 to 2012 and who was at the company when it corrected course after a famously bumpy first attempt at putting the service on smartphones. "It's one of the main reasons why Facebook is where it is today."

Zuckerberg "is a total inspiration in how much he cares about his work and in how


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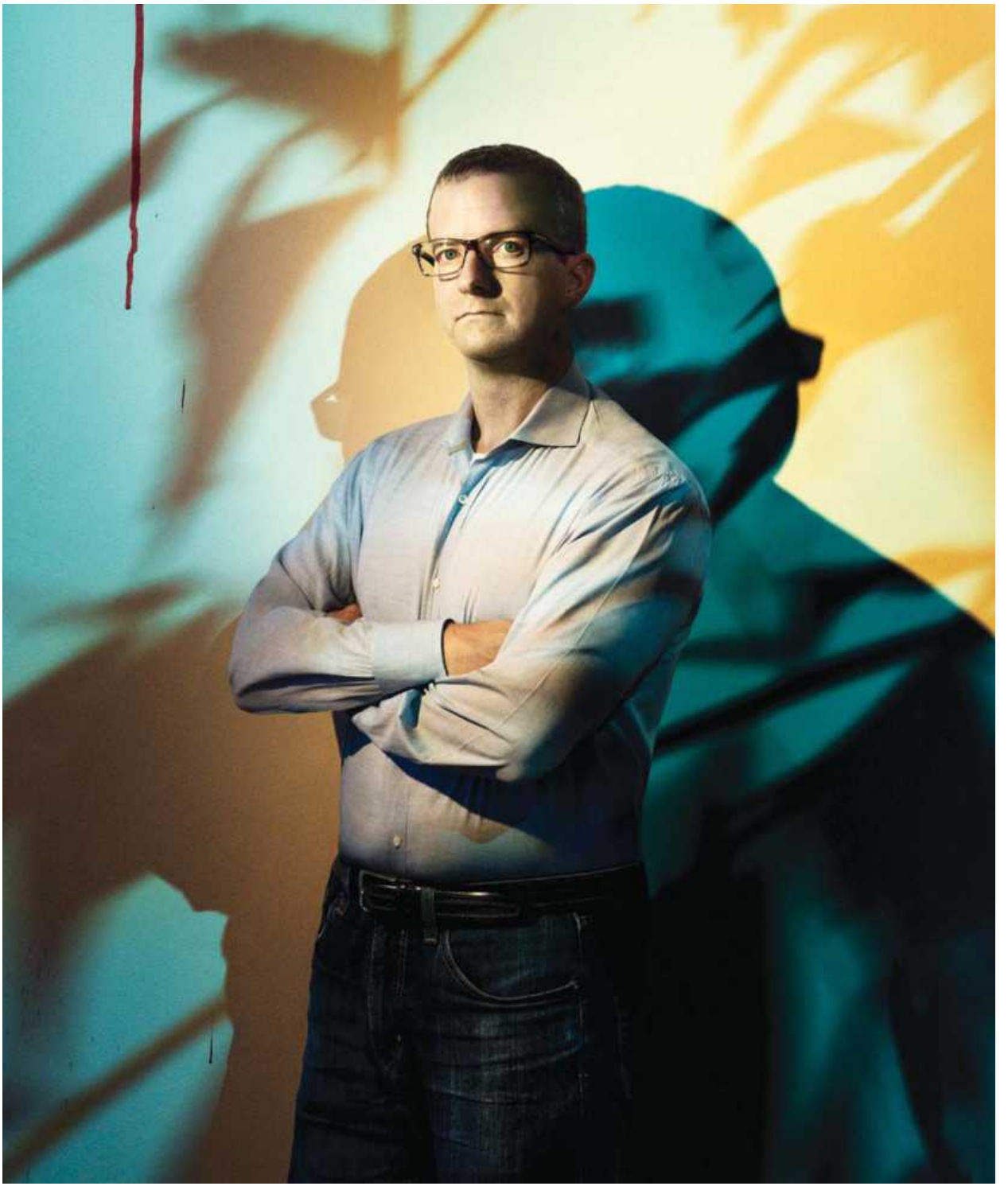
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Mike Schroepfer
CTO

"I have one hand in the day-to-day and one hand in the future. It's a little bit crazy-making at times, but it's important that our core business continues to do well. Because that is what allows us to aggressively invest in these longer-term things."

hard he works," says Chris Cox, who dropped out of a Stanford graduate program in 2005 to join the company as a software engineer and is now chief product officer—and is so integral to its culture that he still speaks with every new employee as part of his or her orientation. "For all of us who work with him, it's like, Man, he is so good at improving."

Sue Desmond-Hellmann is a Facebook board member and CEO of the Bill & Melinda Gates Foundation, which puts her in close proximity to two prodigies who quit Harvard to seek fortunes out west. Both Zuckerberg and Bill Gates, she says, "have this sense of relentlessness. 'Why can't that happen? Why can't we accomplish this?' It can be fun to be around that. It can also be like, 'Oh. My. God.'"

When I meet with COO Sheryl Sandberg, she shares a personal story of a family gathering and making s'mores that captures several of Zuckerberg's preternatural gifts. "Mark said, 'I'm going to make a marshmallow,'" she tells me in her conference room, which is adorned with a framed drawing of her as Spider-Woman. "I looked at my friend and said, 'He's going to make the perfect marshmallow.' Because he's going to be the one out of all of us who is going to have the patience. In order to make the right marshmallow, you can't do it right in the fire, because then it gets burnt. You can't walk away. You actually have to sit there for five

to 10 minutes with the marshmallow above the flame, but not too close, so that it gets completely heated but doesn't burn. And the only person who's actually willing to do that is Mark. Because he is that focused and that determined. I've never met anyone with more perseverance than Mark Zuckerberg."

In hindsight, there were two particular moments that have put Facebook in the enviable position of being able to pursue its most audacious dreams. The first was a recruiting spree back in 2007–2008, when the company concluded that it needed more players with serious Silicon Valley experience. A significant percentage of the current leadership joined during this time, including Sandberg, who came from Google to be the principal architect of the business. From Mozilla, the Firefox browser purveyor, Zuckerberg hired Mike Schroepfer—known universally as Schrep—who ultimately replaced Taylor as CTO.

"The amount of trust and bandwidth that you build up working with someone for five, seven, 10 years? It's just awesome," says Zuckerberg. "I care about openness and connectedness in a global sense. [Sandberg] has the emotional warmth and ability to connect with people that allows us to live that mission inside the company. She's even better than people think she is." As for Schrep, "he's just extraordinary at the patience and composure you need for managing long-term projects."

Zuckerberg, unlike many of his rivals, has been able to keep his leadership team stable. Their cohesiveness led to the second key moment: the Instagram acquisition and its subsequent success.

When Facebook announced that it was buying the photo-sharing juggernaut in April 2012, less than six weeks before its IPO, a flurry of articles followed with titles such as "Five Ways Facebook Will Ruin Instagram." Instead, the deal became a model for how businesses in Facebook's portfolio get managed. Zuckerberg left cofounders Kevin Systrom and Mike Krieger in charge, encouraged them to preserve their own culture, and gave them access to tools—from Facebook's recruiting team to its spam-fighting technologies—that helped them get where they were planning to go anyway, only faster.

"Schrep and I work day-to-day, operationally, on how we build our team, where we hire from, organizational stuff," says Systrom, Instagram's lanky, bearded CEO. "Mark and I work most closely on product. And Sheryl and I work most closely on advertising and strategic issues around policy. Imagine getting to have Mark, Sheryl, and Schrep on your board. Many companies in the Valley would kill to have that. And we get it by default, which is pretty sweet." Instagram's user base tripled in the 10 months after the acquisition announcement, to 100 million monthly users, then doubled in the next 13 months. (It now boasts 400 million users.)

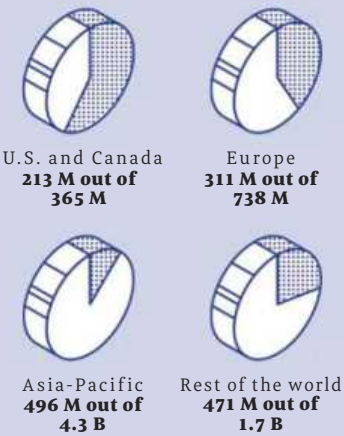
"ONE OF OUR GOALS," ZUCKERBERG SAYS, "IS TO GET BETTER THAN HUMAN LEVEL AT ALL OF THE PRIMARY SENSES."

The lessons Facebook learned from the deal may have been as valuable as Instagram's revenue potential. It began pursuing major acquisitions more aggressively—it acquired WhatsApp and Oculus in early 2014—and then found itself looking at its own services with fresh eyes. Zuckerberg hired PayPal president David Marcus to run its chat product, Messenger, and decided to remove it from Facebook's smartphone version, forcing users to download

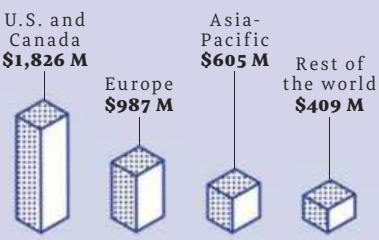
UP AND TO THE RIGHT

Facebook's growth machine is what gives the company its currency to pursue AI, VR, and connectivity.

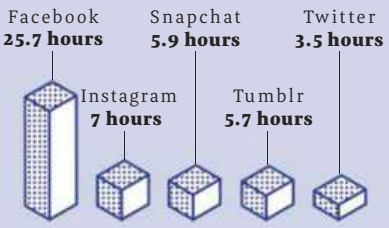
FACEBOOK MONTHLY ACTIVE USERS/POPULATION



REVENUE IN 2015 Q2



TIME SPENT MONTHLY BY U.S. 18- TO 34-YEAR-OLDS



Sources: Facebook 2015 Q2 Earnings Report; comScore 2015 U.S. Mobile App Report

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a stand-alone app. "We were all incredibly uncomfortable with that," says a former Facebook employee who was present when Zuckerberg explained his rationale. "But he had thought it through carefully, the core use cases and the competitive situation." A little over a year later, Messenger's active user base more than tripled.

Splitting Messenger off from Facebook let Marcus begin to build his own business model, one akin to China's messaging behemoth WeChat. Messenger has its own app store, with partners such as ESPN offering animated GIFs, and a feature that allows companies (including e-commerce retailers Everlane and Zulily) to conduct customer service—from delivery tracking to returns—within Messenger. "We're not in a rush," says Marcus. "But over time, we can build a really good business out of these interactions."

Three thousand miles away from Facebook's Menlo Park headquarters, in an office building in New York's Noho neighborhood that was once a Wanamaker department store, a researcher named Rob Fergus is showing me software designed to identify objects in a video stream. Computers have long struggled to learn what's happening in video, which contains so much more data than text or a still photo. He points a webcam that's attached to a laptop running his program at a remote control. The software, which is so computationally intensive that it causes the cooling fans inside his laptop to kick in at a full, ear-piercing blast, thinks the remote is a turtle. He focuses the camera on a computer mouse. Once again, it thinks it's spotted a turtle. Only occasionally does it correctly identify an item.

Fergus looks sheepish. But the point of the demonstration isn't to prove that Facebook is ready to roll out this AI feature, just that they're working on it.

If you've ever felt like your Facebook News Feed is filled with people you don't care about sharing thoughts you didn't particularly want to hear, you'll appreciate why Facebook is pushing to further the art of artificial intelligence. In its current form, the social network is still far better at collecting vast amounts of data than understanding what that data means. Advanced AI could help emphasize the stuff that's truly relevant to you, keeping you on the service longer and boosting your attractiveness as a subject for targeted advertising. "Facebook is working to be at the center of the world of AI because it will affect Instagram, WhatsApp, and Messenger," says Systrom. "It's broadly applicable to all social products."

Lori Goler
VP, People

"People here want their work to matter and their contribution to matter. And they want to work with an amazing team of people who challenge them every day. They actually say, 'I don't ever want to be the smartest person in the room.'"



Facebook has dabbled in AI for years. In 2010, for example, it introduced facial-recognition technology to identify people in photos. In late 2013, though, Zuckerberg came to believe that AI—which he calls "one of the hardest engineering challenges of our time"—was central to the company's future and decided to establish a lab devoted to it. He began courting Yann LeCun, a New York University faculty member and world-class expert in deep learning, to run it. Unlike the archetypal young turk Facebook employee, the 55-year-old, Paris-born LeCun is an éminence grise of his craft, with decades of experience studying machine vision, pattern recognition, and other technologies with the potential to make the social network smarter.

LeCun, however, was disinclined to leave academia or New York. When Zuckerberg thinks Facebook needs something, though, he refuses to treat obstacles as obstacles. He offered to let LeCun set up Facebook AI Research's headquarters in Manhattan and retain his professorship on the side. LeCun came aboard. Problem solved.

Because Zuckerberg would not be able to interact with LeCun in person on a daily basis, he had the AI researchers who did work at Facebook's main campus sit near him so he could learn from them. "When we moved to the new building, we ended up being separated from Zuck by about 10 yards," LeCun chuckles. "He said, 'No, this is too far, move closer.'" And so they did. (This is a signature move that Zuckerberg uses to absorb new material; when the team prepared Facebook's Timeline feature in 2011,

FC spotlight

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he placed key design talent near his desk, and he seated Systrom near him after the Instagram acquisition.)

The mandate for the 50-person AI team is also vintage Zuckerberg: Aim ridiculously high, and focus on where you want to go over the long term. "One of our goals for the next five to 10 years," Zuckerberg tells me, "is to basically get better than human level at all of the primary human senses: vision, hearing, language, general cognition. Taste and smell, we're not that worried about," he deadpans. "For now."

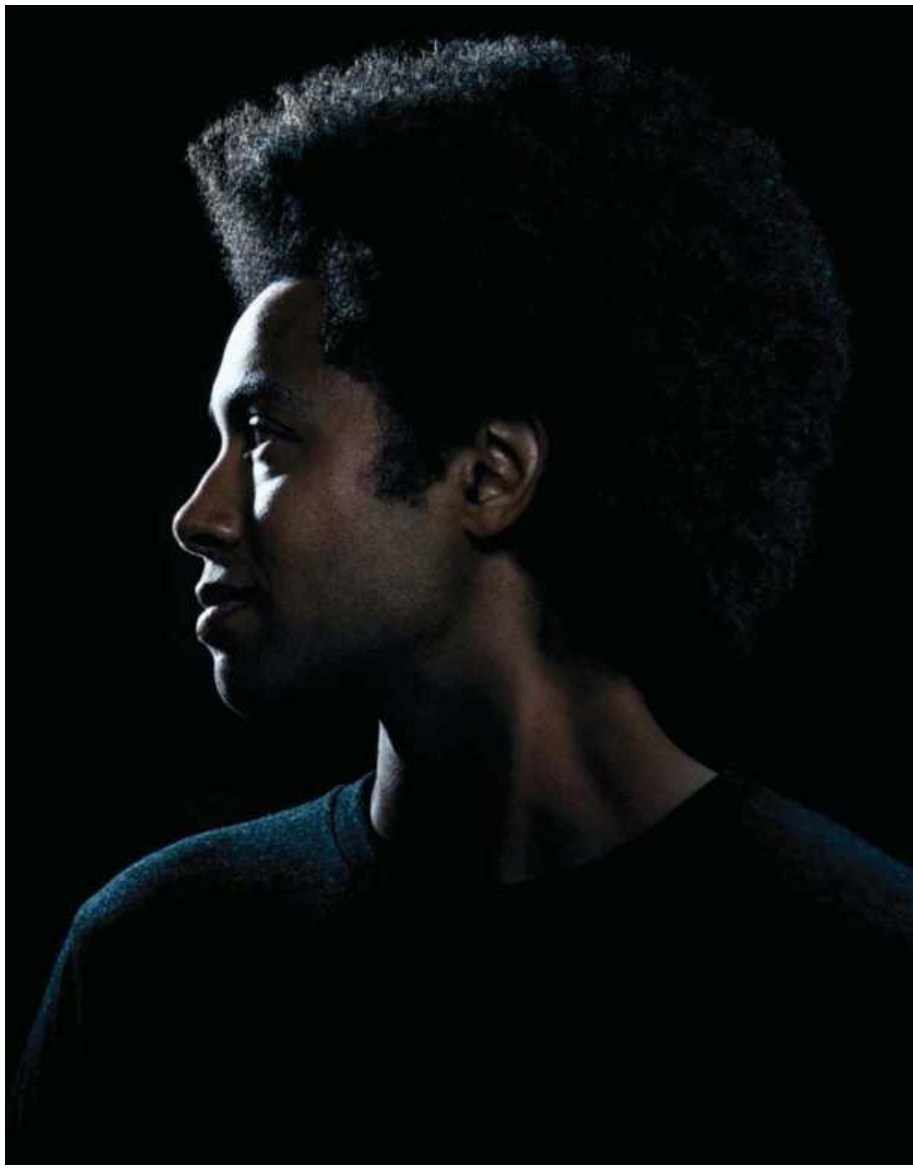
Fergus and his fellow researchers have the freedom to start small rather than think immediately of the massive data problems posed by services with several hundred million users or more. Antoine Bordes, who relocated from a French university to join the New York team (though there's now a Paris branch because the city is also a hotbed of AI talent), is teaching a computer concepts such as "John is in the playground" and "John picked up the football" in order to help it learn to answer queries such as "Where is the football?" Everything draws on a vocabulary of just 50 words, a purposefully dinky number chosen so that researchers can tell exactly what's going on. "This is not big data," says Bordes, who is wearing a T-shirt depicting a robot boxing a dinosaur. "This is supersmall data."

LeCun has given Facebook a lab with a strong universitylike feel. Rather than having to make sure their work lines up with Facebook's product plans, researchers—many of them fellow academics—can pursue their passions while a separate group, Applied Machine Learning, is responsible for figuring out how to turn the lab's breakthroughs into features. "The senior research scientists, you don't tell them what to work on," LeCun says. "They tell you what's interesting."

Technologies incubated by LeCun and his team are already popping up in Facebook products such as Moments, a new app that scours your phone's camera roll for snapshots of friends, then lets you share those photos with those people. "Most researchers do care about their stuff having practical relevance," says Fergus, who is technically still on leave from NYU, where he worked alongside LeCun. "In academia, a great outcome is you publish a paper that people seem to like at a conference."

Yael Maguire
Director, Connectivity Lab

"Our focus is technologies that can advance the state of the art by at least an order of magnitude. We don't want to make something better by a factor of two or three, because the rest of the industry is going to do that."



Photograph by Christophe Wu/Facebook

LeCun's work is directly affecting Facebook's bottom line, in the form of better spam-prevention tools and software to verify that ads are up to company standards, a task that was once a labor-intensive manual process. "I joke that the lab has paid for itself over the next five years with work they've already done," says Schroepfer.

Palmer Luckey and I are flapping our arms in adjoining isolation-booth-like rooms in Oculus's quarters in Building 18 on Facebook's campus. In the virtual-reality world we're sharing, though, Luckey, the endearing 23-year-old wunderkind who founded Oculus VR in his parents' garage in 2011, has transmogrified himself into a hovering, cartoony head and hands, and we're playing antigravity Ping-Pong. Next, we set off fireworks together and he shoots me with a zap gun, which instantly shrinks me to the size of a gnat as he towers above me.

A few days later, when I meet with Zuckerberg for our first conversation, he's eager to talk about Oculus Ping-Pong even before I begin asking him questions. As he delineates the pleasures that user-adjustable physics bring to table tennis, his expression takes on some of the same goofy glee I'd experienced. (Zuckerberg, a gamer himself, is a devotee of *Civilization*, a venerable game series that Oculus CEO Brendan Iribe worked on in a previous life. The goal of the original 1991 version of *Civ*—"build an empire to stand the test of time"—neatly encapsulates its appeal to the Zuckerbergian brain.)

Anyone who's had his or her mind blown by a few minutes of Oculus time in a 3-D, 360-degree world can appreciate why Zuckerberg is grinning. But if Oculus was only about games, it wouldn't be an obvious fit for his mission-first vision of Facebook's future. His interest in VR *(Continued on page 136)*

Billions of dollars in technology to combat the most mind-boggling conundrum of all: flats vs. pumps.

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How Nobel Peace Prize–winning education activist **Malala Yousafzai** is turning her compelling life story into a targeted mission.

By Karen Valby
Photographs by Samantha Casolari



“It’s no longer just my voice. It’s the voice of the people”



A

After Pope Francis finishes his opening remarks at the UN General Assembly, the room's attention quickly begins to stray. Colombian pop star and UNICEF ambassador Shakira launches into a well-intentioned rendition of "Imagine," but the gathered heads of state begin to twist in their seats in conversation and mill in the aisles. Then the song ends, and a gentle but firm voice calls down from the upper mezzanine balcony, cutting through the buzz of distraction.

"Before I start, may I ask for some quiet. Please pay attention to what youth is asking here."

Chastened, the world leaders take their seats. In elegantly simple language, 18-year-old Malala Yousafzai implores the adults below—who have convened to adopt a series of development goals for the world's most underserved communities—to follow through on their promise to deliver free, safe, quality education for children across the globe.

Three years ago, while she was riding the bus home from school in Pakistan's Swat Valley, Malala was shot in the head by members of the Taliban. She'd been targeted because of her history of campaigning, publicly and passionately, for her and her friends' intrinsic right to attend school. She survived and since that heinous day has gracefully become the de facto voice of the more than 60 million girls deprived of education worldwide.

Her appearance at the UN General Assembly in September was part of a whirlwind visit to New York that required her to take a rare two days off from her own schooling in Birmingham, England. The youngest-ever Nobel laureate also attended the premiere of *He Named Me Malala,* Oscar-winning director Davis Guggenheim's documentary about her life. She struck allegiances with world leaders on behalf of her two-year-old NGO, the Malala Fund. And, in what Stephen Colbert called his favorite moment to date on his new show, she performed an

EDUCATION WITHOUT BORDERS

The Malala Fund is dedicated to ensuring that all children, no matter where they live, can go to school through the 12th grade.



1



Pakistan

Sixty-three percent of girls in the country don't attend primary school.

The fund's first-ever grant, in 2013, went toward the education of young, female domestic laborers in Malala's home country. Since then, it's provided grants toward enrolling vulnerable and married girls in secondary-education programs in rural and tribal areas, rebuilding schools for girls following floods in Punjab, and establishing schools for internally displaced children living in Northern Pakistan.

2



Jordan

Tens of thousands of Syrian children reside in two massive refugee camps here. In one of them, 30% of children don't attend school at all.

In July 2015, the fund made a $250,000 grant to help continue education and other programs in the Azraq camp, while also starting an initiative to get girls safely to classrooms—and back. While visiting the Za'atari camp, where the fund supports programs for girls, Malala said, "There are still so many . . . children who cannot go to school, and I think the whole international community should help these children."

Source photos: Nadeem Khawar/Getty Images (Pakistan); Muhammad Hamed/Corbis, Muhammed Muheisen/Corbis (Jordan)

Illustrations by Matt Rota



"The last thing the world needs is just another high-level cocktail party," says Malala Fund director Meighan Stone. "If that opportunity doesn't connect us to real outcomes, then what are we really accomplishing there?"



3



Kenya

Fifty-five percent of poor girls in the country have never been to school. A quarter of Kenyan girls under the age of 15 are married.

Last year, the fund agreed to provide grants to Free the Children's Oleleshwa All-Girls' Secondary School, which educates economically disadvantaged girls living in rural areas of the country, and NairoBits, a coding academy that will prepare 300 girls for jobs in the information and communication technology industries. On her first visit to Africa, in May 2014, Malala met with girls in the Masai Mara to discuss the issues they face while trying to pursue their education, including school fees and early marriage.



4



Nigeria

Nigeria has the highest percentage of school-age girls worldwide who don't receive any education, with the average girl leaving school by age 9.

The Malala Fund has offered a grant to the Centre for Girls' Education, an NGO that operates learning clubs for girls living in the rural north, and set up counseling and scholarships for girls who escaped Boko Haram. In July 2014, Malala acted as an intermediary between former president Goodluck Jonathan and the families of girls kidnapped by the Boko Haram terrorist group, urging the leader to save the still-missing girls. "We will not rest until you have been reunited with your families," she said in an open statement.

eye-popping card trick for 3.2 million viewers on network television.

But Malala is doing more than building awareness: She's creating a network of action and impact. Her still-young Malala Fund has already helped finance projects in six countries—Pakistan, Nigeria, Kenya, Jordan, Lebanon, and Sierra Leone—by opening schools, providing scholarships, and setting up education groups and remote-learning programs. While the fund's budget today is modest (it spent more than $4 million in 2014), Malala has created a model for other NGOs, local government, and, yes, world leaders that shows how on-the-ground engagement can be effective. What's more, she's already had international impact—at the UN—that has gone largely unrecognized, despite all the media she's attracted. "In the beginning, people ignore you," Malala tells me during a conversation at the fund's Washington, D.C., coworking space a few weeks before her New York blitz. "And then they say, 'Okay, now we have to listen because she is not going to keep quiet.' So you keep speaking. And once young people join the mission, it's no longer just my voice. It's the voice of the people."

In person, Malala is both relaxed and deeply attentive, a high school junior who doesn't wear makeup or carry a cell phone. The left side of her face is still partially paralyzed from where the bullet inflicted permanent nerve damage. When I first meet her, she is wearing traditional Pakistani clothing and the same pair of modest platform sandals she'll wear in New York in order to give her 5-foot frame an extra inch to see over the average lectern. True power clearly knows nothing of stature or age. As becomes increasingly evident during conversations with her, her family, and her team, Malala has a force that's completely devoid of bombast or ego.

When the Taliban took over the Swat Valley in 2007, bombing schools and murdering resisters, the world did not send help. Politicians failed to act. NGOs that pledged financial aid and on-the-ground resources were unable to deliver. Malala's terrorized community was left to fend for itself. Malala and her father, Zia, a peace activist who ran the school she attended in Swat, continued to speak out. When she woke up in a hospital bed in England, ripped from her home and culture, they decided together that still more needed to be done.

In 2013, they started the Malala Fund to make the broad, irrefutable statement that every girl deserves an education—and translate that belief into action on both the local and global level. Its mandate, as set by cofounders who know well the cost of being let down, is to prove there are bolder, braver, more effective ways to support girls than the failed efforts of those who'd left Malala to her fate in Swat Valley.

This past year, the Malala Fund began a phase of explosive growth, fueled by a ramped-up staff; grants and donations from supporters including Microsoft, the Skoll Foundation, and *Star Wars* director J.J. Abrams, plus small-dollar donations from a public besotted with Malala and her efforts; and global interest the average NGO could never imagine. All this because of the clear-eyed vision of an 18-year-old.

"Dear sisters and brothers, world leaders, please look up, because the future generation is raising their voice."

Meighan Stone has a mantra: Don't get confused.

Before becoming director of the Malala Fund last April, Stone spent 15 years working in the NGO world—including stints at Bono's ONE Campaign and the UN's World Food Programme. She knows how easy it can be to mistake an A-list conversation for an actual commitment. "Malala has the ability to sit with world leaders and influential business-world leaders," says Stone, but "the last thing the world needs is just another high-level cocktail party. If that opportunity doesn't connect us to real outcomes, then what are we really accomplishing there?"

Stone's team—a group of 20 predominantly young women spread out over coworking spaces in Washington, D.C., New York, and London—is in the middle of a sprint of 18- to 20-hour workdays as they prepare for the UN Sustainable Development Goals Summit and the opening of *He Named Me Malala*, one of the largest global releases of a documentary ever. The film is both a call to action and a highlight reel for much of the fund's early activities.

"It's so rare that NGOs get these opportunities, especially around this issue of girls' education," says Stone, knocking on her cluttered desk in her cramped office. "We

Source photos: Malala Fund/Tanya Malott (Kenya); Michael Gottschalk/Photothek/Getty Images (Nigeria)



"If you want to go reach the refugee children, if you want to go to conflict areas, it's always hard," says Malala's father, Zia. "And if you don't have a courageous, bold team, it doesn't happen."

"IT IS WONDERFUL TO SEE THESE LITTLE GIRLS, MOST OF WHOM I KNEW FROM THE STREETS...IN THE SCHOOL WITH UNIFORMS AND BOOKS," MALALA SAYS.

want to make sure we do everything we can in this unique moment. We have the best inspiration in the world, with Malala and her father. They choose every day to do this work, and they work so hard. None of us could work harder than them, ever."

No one would have blamed them if they'd retired from a life of service. After Malala was shot—and transported, in a coma, to Birmingham, England—her family spent several painful weeks wondering if she would survive, let alone return to her vibrant self. Zia blamed himself for letting his daughter stand up so defiantly to the Taliban. "After going through this life-and-death situation, I was worried," he tells me. " 'What will she be thinking? Why didn't we stop her? Why did we encourage her?' But believe me that she woke up the same old girl. I have never heard a single word of repentance or regret: 'Okay, I have lost my smile or my half-face is not working yet,' or 'If I had not done that, I wouldn't have faced this.' Never, never, never! And when we saw this new resilience and passion and commitment, it also gave energy to us."

They also drew strength from people worldwide who rallied immediately around Malala. Unsure how to navigate the flood of support during his daughter's early days of recovery, Zia asked Shiza Shahid, a then–23-year-old Stanford graduate from Pakistan and longtime family friend, to leave her job at McKinsey & Co. in Dubai and join them in Birmingham. Soon came a book deal for Malala's international best seller, *I Am Malala*, a meeting with Hollywood producers Walter Parkes and Laurie MacDonald—who would coproduce the documentary adaptation—and offers of advice and assistance from heavy hitters like Megan Smith (the White House CTO who was then a vice president of Google X), Facebook's Sheryl Sandberg, and the international women's advocacy organization Vital Voices.

In July 2013, the fledgling fund, with an assist from former U.K. prime minister Gordon Brown, arranged for a still-healing Malala to make her first public address at the UN, on her 16th birthday. That October, Stone, then working as an adviser to the fund, helped coordinate a meeting with President Obama at the White House, where Malala took the opportunity to voice her concerns about the U.S.'s ongoing use of drone attacks.

And then, the following October, while Malala was head-down in her morning chemistry class, she learned that the Nobel Peace Prize Committee had announced her as the youngest-ever winner. She shared the honor with Indian activist Kailash Satyarthi. "This award is for all those children who are voiceless, whose voices need to be heard," Malala said in a digitally broadcast Nobel acceptance speech, which the fund coordinated with Facebook to maximize its reach. "And I speak for them, and I stand up with them, and I join them in their campaign."

The new documentary ends on this triumphant note. What the film doesn't show is that Malala went on to use her half of the $1.1 million Nobel Prize money to personally finance the building and operation of a secondary school for girls in Pakistan, adding to the work the fund had already begun in the country, such as increasing girls' access to education, helping revitalize two schools damaged by the 2014 floods, and financially supporting the families of girls who had spent their earlier years as child laborers. "Sometimes I talk to them on Skype, and it is wonderful to see these little girls, most of whom I knew from the streets," says Malala. "Now I see them in the school with uniforms and books."

In 2014, its first full year of operation, the Malala Fund committed more than $4 million toward supporting local education programs in its six priority countries. Malala and her team fervently believe that the last thing a developing country needs is another well-intentioned Western team coming in to fix things yet bungling the details. So unlike many traditional NGOs, they ferret out highly trusted partners on the local level, giving respected community leaders the support and infrastructure they need to make a difference. "People always ask us, 'How do you find all these developing-country partners?'" says Stone. "And we're like, 'Why haven't you found them before?' I think we're just scratching the surface. We're hoping to find so many more Malalas and Zias who we can support. There are people in all these countries who have been fighting this fight for a long time with no funding and no recognition."

Zia, now the UN's special adviser on global education, understands that "if you want to go reach the refugee children, if you want to go to conflict areas, it's always hard. And if you don't have a courageous, bold team, it doesn't happen." He attributes much of the fund's success thus far to its director of special projects, Eason Jordan, a 23-year CNN veteran who ran the network's international division in the early 2000s. ("Where there is an Eason, there is a way," says Zia.) After hearing Malala speak of her desire to visit refugees in Jordan in a late-2013 interview with CBS, the newsman contacted Shahid and offered up his services, pro bono. "I told her, 'That's a part of the world where I have a lot of experience, and I'd be happy to make it happen,'" he recalls.

Jordan (the man) made an advance trip to Jordan (the country) at his own expense and returned again to meet Malala and Zia near the Syrian border. "It's the only time I've ever seen Malala cry," Jordan says, "seeing those hundreds of Syrian refugees walk on foot, in some cases without shoes, across the desert to the Jordanian border. Malala and Zia decided they had to help and literally walked into Syria and carried children out across the border and put them into trucks to take them to refugee centers in Jordan."

Jordan joined the team officially in March 2014. He calls his affiliation with the fund "the most rewarding experience of my life." In honor of Malala's 17th birthday that July, he helped organize a trip to northern Nigeria. Malala sat and comforted the parents whose daughters had been abducted by Boko Haram—and the girls who had narrowly escaped. "It was so tragic, because 100 days had passed and the president had not met with any of them," she says. The same day, Malala sat down with Nigerian president Goodluck Jonathan and, with polite firmness, demanded an explanation for his failure to respond. Within a week of their conversation, Jonathan met with the families and offered them financial support.

"PEOPLE ALWAYS ASK US, 'HOW DO YOU FIND ALL THESE DEVELOPING-COUNTRY PARTNERS?'" SAYS STONE. "AND WE'RE LIKE, 'WHY HAVEN'T YOU FOUND THEM BEFORE?'"

The following summer, on Malala's 18th birthday, Jordan took the team to Lebanon, where they opened a school for adolescent Syrian refugee girls—as Assad's helicopters dropped bombs on opposition fighters 20 miles away. After the ribbon-cutting ceremony, Malala immediately met with Lebanon's prime minister to urge him to take his own action. "If *I* can open a school there, why can't world leaders?" she asks.

When Malala shows up in these desperate communities, most girls don't know that she's an international best-selling author or a beloved global advocate. "What matters to them is that somebody their age is coming in and fighting for them and succeeding in helping them get the support they need to get the education they deserve," says Jordan. He wouldn't say where they were planning to go for Malala's 19th birthday. "But you can bet it won't be a Caribbean island. There is danger involved in working and traveling to these places, but Malala feels very strongly that if this is where help is most needed, she has to go."

A week before Malala's UN appearance, the team was tired. "Before any big project there's always this nadir moment where everything is going wrong and everyone is despondent and no one is happy," says Stone. That morning her own spirit was flagging as the fund fought to get clearance for a Syrian refugee named Muzoon, who has become a Malala-level figure to young people in her Jordan camp, to join them in New York as she had in Oslo, for the Nobel acceptance. "She has no papers; she's stateless," explains Stone. Securing Muzoon's passage to Oslo had involved calling in favors from the UN secretary general's office, the king and queen of Jordan, and the prime minister and foreign minister of Norway. On her return trip, at the last minute, Muzoon was denied clearance back to the refugee camp; the girl and her father slept overnight on the floor of an airport. "This is how we treat girls who are refugees," says Stone, her face reddening with indignation.

Source photos: Malala Fund/Tanya Malott (Sierra Leone); Malala Fund/Malin Fezehai (Lebanon)



5



Sierra Leone

One-quarter of children were not in school in 2013. Last year's Ebola crisis killed at least 79 educators and put 1.8 million children out of school for nine months.

In 2015, the fund provided grants to train teachers' aides for a program that broadcasts lessons via radio to 1,200 girls at 40 Empowerment and Livelihood for Adolescents clubs throughout the country. Before accepting her Nobel Peace Prize in December 2014, Malala teamed up with fellow recipient Kailash Satyarthi to call for the reopening of schools in Ebola-stricken West Africa.



6



Lebanon

More than 80% of the almost 400,000 Syrian refugee children in Lebanon do not attend school.

In July 2015, the fund helped open the Malala Yousafzai All-Girls School in the Bekaa Valley, which provides girls ages 14 to 18 with vocational skills and college prep and employs Syrian women as educators. "We are in danger of losing generations of young Syrian girls due to the lack of education," Malala said at the opening, on her 18th birthday. "Today, on my first day as an adult, on behalf of the world's children, I demand of leaders we must invest in books instead of bullets." *—Nikita Richardson*

The fund fights to get girls like Muzoon onto a global stage in order to force the world to recognize both their plight and potential. Malala represents an entire generation of unknown children from unknown places who can have a dramatic, positive impact on our future if just given the opportunity. "When was the last time we heard from a girl who was a refugee?" says Stone. "Can you think of any time, in a meaningful way? It doesn't happen." On the fund's website and at events, the girls always speak for themselves, in their own voices. The fund has a strict rule about using photos in their press materials of only girls they actually serve. These girls are never presented as illiterate or hopeless, but as eager, determined, and as ready to learn as the children of world leaders.

In D.C., I meet a program manager named Leila Seradj, who has just returned from a 10-day trip to Kenya, visiting a tech-education program that the Malala Fund supports: makeshift centers in three Nairobi slums set up by the local organization NairoBits. "I was blown away by the work being done there," says Seradj. "It's a cramped, tiny, dim room, with people doing laundry outside in buckets. But [the girls] are learning to create websites, design them, code, stuff I could never do. They're hungry to learn and help their families and communities." Seradj tells me about a Nairobi teenager she met named Rose, who was orphaned at the age of 6, has a baby of her own, and knows how to code. Someone as eager and capable as Rose completely upends stereotypes of what it means to be a girl in a developing country.

"Are we taking as an assumption that girls only have a right to basic literacy and numeracy?" says Stone. "Or are we putting a picture out into the world of what we know to be true, which is that these girls have extraordinary ability? And if they can go to school until 18 and beyond, learn physics and algebra and languages, they can be leaders in their communities and countries and the world."

Last summer, the team paid a visit to Muzoon, whom Malala now considers one of her best friends, at her camp in Jordan. The girl appears briefly in the documentary, and they wanted to share the film with her in advance. "When we left the camp, they locked the gate behind us," says Stone. "And I just started crying. I'm the president of an organization. I'm not supposed to cry in front of my colleagues! But this young woman, who has everything to give, is in a camp because the world says she's stateless. And because I have a piece of paper, I'm allowed to walk through a gate. That's what keeps me up at 2 a.m., looking at the ceiling, being like, 'We've got to work harder!' It's not the time for us to do a victory lap and be like, 'Oh, look at us!' So what? What is the impact on a girl like Muzoon?"

> "I USED TO PRAY TO GOD A LOT SO THAT HE WOULD GIVE ME THIS POWER SO I CAN CHANGE THE WORLD," MALALA SAYS. "AND I REALIZE THAT I HAVE THIS POWER NOW."

"This one's for Malala," says Eddie Vedder, dedicating a song to the young activist at September's Global Citizen Festival, the star-studded concert in Central Park featuring Pearl Jam, Beyoncé, Coldplay, and more. Malala had just spoken onstage moments earlier as yet another stop on her New York media tour. She was introduced by Bono and flanked by a small entourage of girls: Shazia, one of her former Swat Valley classmates, who had been hit by bullets while sitting beside Malala on the school bus; Salam, a Syrian refugee who attends a school that the Malala Fund opened in Lebanon last summer; and Amina, a Nigerian girl from an area often targeted by Boko Haram, who now mentors at a Malala Fund "safe space," part of a learning club that serves out-of-school girls. Muzoon would have been there as well; her travel papers ultimately failed to come through.

Malala is aware of the attention that follows her every public move, and she is bent on deflecting it toward the millions of young women whose names people don't know. "I consider these girls my sisters," Malala tells me. "My life is so connected to girls in Nigeria and girls from Syria who are refugees, *(Continued on page 138)*

Elon Musk, the CEO who made electric cars sexy and commercial space travel a reality, is venturing into the messy battery business. Here's why it's his boldest bet yet.

By Max Chafkin

"The issue with existing batteries is that they suck"





E

Elon Musk walks briskly onto the stage as hard rock blasts in the background. The guitar riff, which sounds like entrance music suitable for a professional wrestler or a minor-league cleanup hitter, fades out, and Musk surveys the crowd, nodding his head a few times and then sticking his hands in his pockets. "What I'm going to talk about tonight," he says, "is a fundamental transformation of how the world works."

The 44-year-old CEO of Tesla Motors and SpaceX (and the chairman of the solar energy provider SolarCity) is wearing a dark shirt, a satin-trimmed sports coat, and, at this moment, a knowing smirk. An admirer of Steve Jobs, Musk is an heir to the Silicon Valley titan in some psychic sense, but in a setting like this, he'd never be mistaken for the Apple founder. Jobs worked the stage methodically, with somber reverence and weighty pauses, holding tightly choreographed events on weekday mornings for maximum media impact. Musk's events, which are generally held at the press-unfriendly hour of 8 p.m. Pacific time, have a more ad hoc feel. His manner is geeky and puckish. He pantomimes and rephrases, rolls his eyes, and cracks one joke after another—his capacity for expression barely keeping pace with the thoughts in his head.

Musk begins by showing an image of thick yellow smoke pouring out of a series of giant industrial chimneys, contrasted with the Keeling Curve, the famous climate-change chart that shows more than 50 years of carbon dioxide levels soaring toward a near-certain calamity. It could be mistaken for something out of Al Gore's *An Inconvenient Truth*. "I just want to be clear," Musk says, with a nervous giggle, his accent betraying his boyhood in South Africa. "This is real."



Tesla's Gigafactory, being built outside Reno, Nevada, will be the second-largest building in the world by volume. "It will blow your mind," Musk says by way of warning.



His comments on this April evening, in front of a raucous crowd of Tesla owners (and some reporters) at the company's design studio in Hawthorne, California, are quintessential Musk—weighty but also a bit cheeky. They're also just preamble. His electric-car manufacturer is launching a new product line: large batteries that store energy in homes and even larger batteries that do the same for utilities and businesses. The Powerwall, a slender appliance designed to be mounted in your garage, comes in five colors and starts at $3,000; the Powerpack, an 8-foot-tall steel box that looks a bit like a utility transformer, is aimed at the energy industry and costs roughly $25,000. These prices are roughly half of what competing battery manufacturers charge.

"The issue with existing batteries is that they suck," Musk says. "They're expensive. They're unreliable. They're stinky. Ugly. Bad in every way." The idea is to pair the new Tesla products with solar panels—either on the rooftops of homes or in large-scale solar farms—that will store energy during the day, when the sun is shining, so that it can be used in our homes, for free, at night instead of energy from power plants that produce greenhouse gases.

Musk thinks it just might be the key to solving the problem of global warming. He explains that if the city of Boulder, Colorado, population 103,000, bought a mere 10,000 Powerpacks and paired them with solar panels, it could eliminate its dependence on conventional power plants entirely. The U.S. could do the same with only 160 million of them. Then he offers even higher figures: 900 million Powerpacks, with solar panels, would allow us to decommission all the world's carbon-emitting power plants; 2 billion would wean the world off gasoline, heating oil, and cooking gas as well. "That may seem like an insane number," says Musk, but he points out that there are 2 billion cars on the road today, and every 20 years that fleet gets replaced. "The point I want to make is that this is actually within the power of humanity to do. It's not impossible."

If there's something a little crass about a save-the-world pitch that ends with a plan to sell the general public $50 trillion worth of a new, unproven product, well, then, that's Musk, too. After founding two successful Internet companies during the dotcom era (the latter of which, PayPal, was sold to eBay for $1.5 billion), Musk has made it both his mission and his business to help us save ourselves from ourselves. In doing so, he's become one of the most successful startup founders of the past two decades. His rocket company, SpaceX, may one day provide an escape hatch should Earth ever be destroyed, as Musk loves to boast; for now, among other revenue streams, it's got a nice $5 billion business launching cargo (and soon, astronauts) to the International Space Station. Tesla may be on a mission to rid the world of fossil fuels, but today, it's a luxury-car manufacturer with a wildly successful product. According to Musk, the company's Model S sedan outsold the Mercedes-Benz S-Class in the U.S. during the first half of 2015 and is on track to sell 50,000 cars for the year.



Musk estimates that 160 million Powerwall batteries, combined with solar panels, would wean the U.S. off conventional power plants entirely.

AS MUSK PUTS IT ARCHLY, "THE SUN DOESN'T SHINE AT NIGHT."

Tesla's rise, in particular, has been stunning. Musk was widely mocked in the mid-2000s when he began describing a plan to build a high-end electric sports car that would be cheaper, better, and faster than a gas-powered one. Electric cars were known for being slow, impractical, and dorky, and no American entrepreneur had successfully established a car company of any kind since Walter Chrysler did it in 1925. Musk spent years deflecting criticism from pretty much every serious automotive expert and nearly went broke in the process. And yet Tesla's designs not only made it onto production lines—they turned out to be amazing.

Better than amazing, even. The latest edition of the Model S, created by a team far removed from Detroit and led by a guy whose previous claim to fame was being fired from PayPal in a boardroom coup, received a score of 103 from *Consumer Reports*, which was a problem only in that *Consumer Reports* ratings are typically scored out of 100. (The magazine had to revise its scale

Opening spread: Scott Olson/Getty Images

Photograph by McNair Evans

in response to the record-breaking result. It has since tempered its enthusiasm after raising questions about the cars' reliability, sending Tesla's stock price plummeting.) The Model S also holds the highest safety rating ever from the National Highway Traffic Safety Administration.

Now, Musk is doubling down, expanding the capacity of the company's main car-assembly plant in Fremont, California (which will eventually produce hundreds of thousands of cars a year), while building a factory-to-end-all-factories outside Reno, Nevada, that will produce battery packs for both cars and homes. Over the six days following Musk's presentation, which was posted on YouTube and the company's website, Tesla reportedly received reservations for $800 million worth of Powerwalls and Powerpacks, about what it makes in almost three months selling cars.

"I think we've really struck a note, without salespeople or advertising," Musk tells me. "With that you can do anything."

"Do you know the difference between power and energy?"

"Uh," I start to respond.

"Do you know the units?"

I've asked Musk a question about improvements in battery technology, but instead of an answer, he's decided to give me a pop quiz.

When I offer the right answer for energy—"Joules?"—Musk smiles. "Hey!" he says. "Not bad. What's power measured in?"

Silence.

"Watts," he says and then adds, admonishingly, "I mean, those are very important. Power is how fast you can run. Energy is how far you can run."

Musk is saying this to make a point. Unlike computer chips, which have improved wildly over the past decade, batteries have proved stubbornly resistant to huge jumps in performance and cost efficiency, in part because we ask so much of them. Today's lithium-ion batteries must fit into tight spaces—either stuffed in a pouch behind an iPhone screen or, in the case of the Model S, lined up by the thousands in a battery pack that reportedly weighs more than 1,000 pounds and runs the length of the chassis. They must last for years. And they must be stable enough to perform well in extreme temperatures (and not burst into flames).

THE GIGA-ECONOMY

Tesla's new battery-making facility, known as the Gigafactory, is going to be big. But did you know *how* big?

June 26, 2014
Ground broken

Early 2016
Battery production expected to begin

$5,000,000,000
Estimated cost of Gigafactory

200
Sites considered

100
Backhoes used to level the site

3,000
Total acres of land area

550
Construction workers

6,500
Employees (at full capacity, estimated)

13,600,000
Planned square footage

50
Total storage capacity of the battery packs produced each year (by 2020) in gigawatt-hours

30%
Decrease in kilowatt-hour cost that Tesla's new battery pack will provide

3.5 million
Square footage of One World Trade Center

4.9 million
Square footage of the Mall of America

5.3 million
Square footage of Tesla's Fremont, California, factory

0%
Amount of fossil fuels that will be used at the factory. Giga is 100% electric.

Moore's law, the principle that holds that computing capacity doubles every two years, does not apply. "The nature of battery innovation is that it tends to be incremental," says Musk. "It's really rare that there's a big breakthrough because there are so many constraints. You can easily improve, say, the power, but then it'd make the energy worse."

Musk generally relishes the role of sustainable-energy schoolmaster, but he seems more irritable than usual on this occasion, perhaps because he has spent the day at a Los Angeles County courthouse. Most people regard jury duty as an inconvenience; Musk, whose schedule requires him to split his time between SpaceX and Tesla while sharing custody of his five sons with his ex-wife, Justine Musk, looks like he just survived a natural disaster. "It's a staggeringly inefficient process," he says, frowning.

Jury duty had taken all day, and Musk was tired, so rather than meet at his SpaceX offices in Hawthorne, California, as we'd originally planned, he has invited me over to his house. Wearing jeans and a T-shirt, he pads into the piano room of his 20,000-square-foot chateâuesque mansion, offers me a large refillable water bottle, and collapses into an armchair.

Musk shares this home, which he bought in 2013, with his wife, the British actress Talulah Riley. The place is well appointed—there's a watercolor behind Musk's chair that looks like a Chagall and a *Mad Men*–style bar across the room—but it also seems barely lived-in. The only personal touches I can see are a coffee-table book about Nikola Tesla and a large piece of SpaceX's rocket engine mounted in a niche on the wall. When I mention that the rocket part, which Musk tells me is a turbopump, looks almost like a work of art, Musk is pleased. "It's sort of meant to be," he says, putting his hand on a small aluminum turbine and turning it slowly. "On the engine, this goes at 30,000 rpm and uses 10,000 horsepower. It's kind of amazing it doesn't explode."

There's a fine line between speed and death, and it's one that Musk seems compelled to walk. He had canceled our first meeting several weeks earlier because he needed to leave town unexpectedly. I later learned he'd taken Riley wing walking on a biplane in Hampshire, England. (Musk lives big, even in matters of the heart. He and Riley have been married twice and divorced almost twice—they reconciled last summer before their second divorce went through.) "It felt like the closest to flying to anything that I've experienced," Musk says of the adventure, noting that he was strapped into a harness while he stood on top of the plane's wings. "There's no danger that you're going to fall off. The danger is that you're flying in a plane that was literally built in the 1940s. It has one engine, and it's made of wood. In fact, I Googled 'wing walker,' and the top result was something like 'famous wing walker dies in horrific accident.' "

Musk did it anyway, of course, posting a triumphant picture on Instagram. "Went for a nice wing walk today," his caption read. "What could possibly go wrong?"

(Continued on page 139)

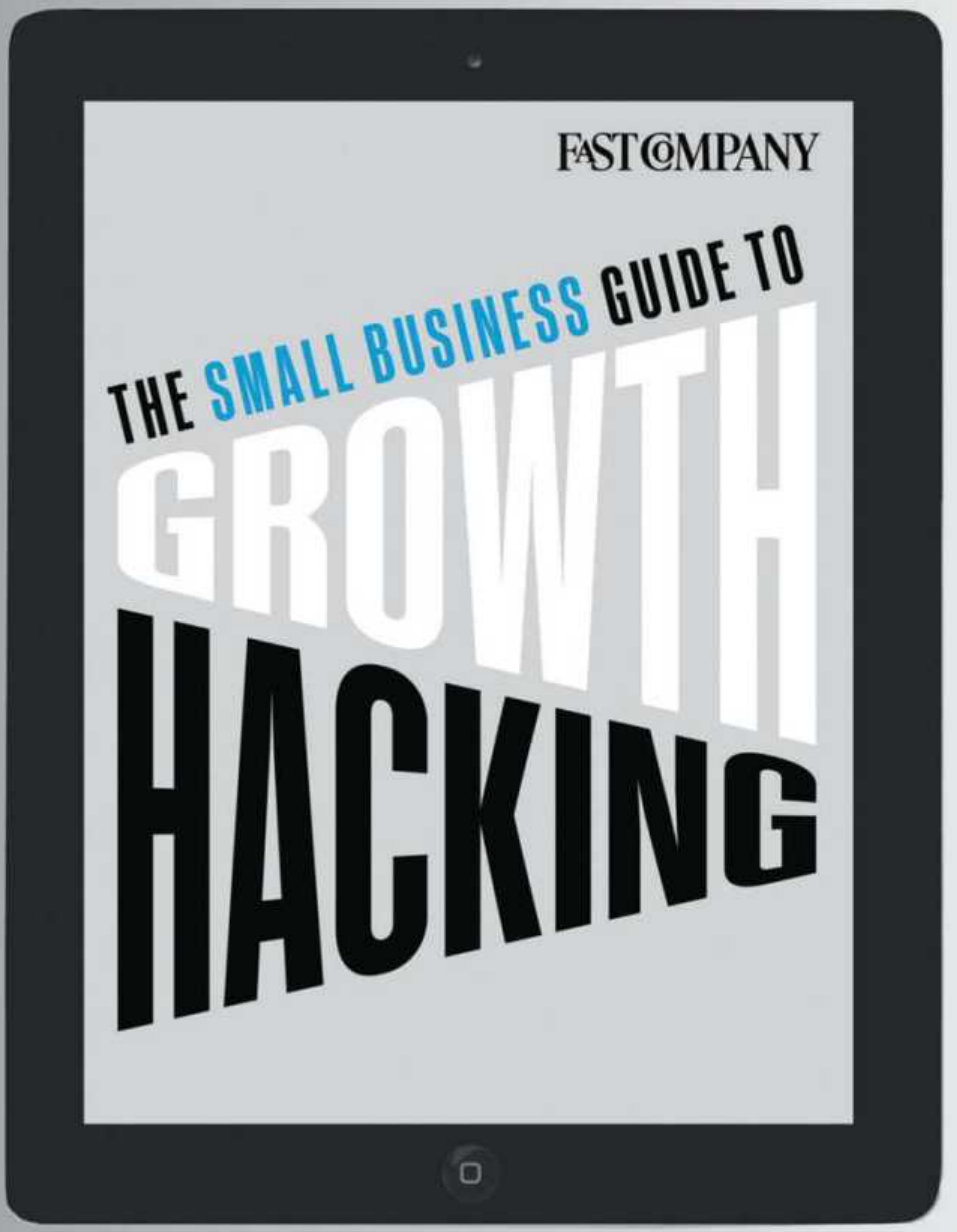


"The biggest leverage we have in making electric vehicles more affordable for everyone is reducing battery cost," says Tesla CTO JB Straubel.

Photograph by McNair Evans

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Light painting and photograph by Christopher Noelle

South San Francisco **Pavlodar, Kazakhstan** **Mendocino County, California** **Austin**

Photograph by Vivek Singh



CHINA IN INDIA

Chickpet Market

Bangalore, India
October 9, 2015

India is now officially the world's fastest-growing economy. By 2017, it will surpass the U.S. to become the second-largest smartphone market. But the majority of Indians don't yet have a ton to spend on phones. Beijing-based electronics maker Xiaomi—which sells high-end devices nearly at cost, generating profits from web services—is moving quickly to meet the country's need. Since toppling Apple earlier this year to become the largest smartphone vendor in China, Xiaomi has bet big on India, partnering with Foxconn to assemble its first India-made phone, the $100 Redmi 2 Prime, thanks to recent tax laws that lower manufacturing costs. (The phone is now Xiaomi's top seller in the country.) Meanwhile, the company is corralling superfans like 32-year-old IT–firm owner Guru Hangala (center), who helps moderate its bustling user forums, as beta testers for locally tailored features, such as a button that stanches data flow to prevent bill overages. To Hugo Barra, Xiaomi's global VP, the opportunity is clear: "In India, a lot of [young people] won't have a PC. They're only going to experience the Internet through their mobile phone." In other words, there's a new generation of Xiaomi fans in the making. *—J.J. McCorvey*

Vivek Singh/Global Assignment


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D.K. CREATIONS
Wholesale Dealers in: CHUDIDAR SET
Vee Fashion
Cash & Carry
KA 02 AC 2873



Photograph by Melissa Golden



CYBERSECURITY

IBM Security Operations Center

Dallas
October 7, 2015

These computer experts are monitoring real-time global threat activity and possible attacks against IBM's corporate clients: more than 12,000 businesses in 133 countries. The "Threat Globe" graphic, second from left, combines historical data—attack origin and method—with current intelligence to help pinpoint and evade perpetrators. Lately, security firms have been responding to a rise in waterholing—hacks by organized crime or foreign operatives into systems used by mobile business executives (such as free Wi-Fi at a coffee shop or a favorite news site). In the future, they'll develop more and more ways to protect employees' laptops, email, servers, and mobile devices that include software, subscription-based services—and even physical hardware. One company, Norse, has launched an appliance that plugs into a company's network, tracks attempted intrusions, and can even create "honeypots" (fake servers that trap and profile potential infiltrators). Research firm Cybersecurity Ventures predicts that nearly $170 billion will be spent on cybersecurity worldwide in 2020. *—Neal Ungerleider*



GENETIC EDITING

Virginia Tech's Fralin Life Science Institute

Blacksburg, Virginia
October 8, 2015

These little swimmers are mosquito pupae. But not just any mosquito pupae. They are transgenic mutants, created by researchers at Virginia Tech's Fralin Life Science Institute using an extraordinary new gene-editing tool called CRISPR/Cas9. Developed contemporaneously in 2012 by separate teams at the University of California, Berkeley and the Broad Institute of MIT and Harvard (and subject to an ongoing patent dispute), CRISPR/Cas9 allows researchers to cut and paste DNA with unprecedented accuracy and speed. And unlike earlier gene-editing tools, CRISPR/Cas9 is species-agnostic, working in insects, fish, mice, monkeys, and, most controversially, humans. CRISPR/Cas9 is already being applied toward cures for diseases ranging from cystic fibrosis to cancer; it could also open the door to the precision engineering of human embryos, prompting calls for regulation. Research on mosquitoes will affect human health more indirectly but with no less impact. Scientists hope to impart permanent genetic changes in wild mosquito populations, such as rendering them sterile or immune to pathogens like malaria—which killed more than half a million people in 2013.
—Adam Bluestein



Photograph by Andrew Tingle

CONNECTED CITIES

Santander, Spain

October 10, 2015

Since the northern Spanish city of Santander installed more than 12,500 sensors downtown between 2010 and 2013, it has become a hotbed of smart-city experimentation. Now, officials know when streetlights aren't working, when garbage cans are full, and when people face higher-than-normal levels of pollution. The European Union–funded project heralds a new era of urban responsiveness and cost efficiency. Santander is already spending 20% less to light its downtown parks, for instance, because lamps now come on only when people are actually present. The city's high-tech infrastructure has attracted innovators from all over the world. Recently, it piloted an LED streetlight from Ericsson and Philips that doubles as a Wi-Fi and 4G antenna. This should allow residents to function as part of the city matrix so they become nodes of intelligence as well. *—Ben Schiller*





Photograph by Luca Locatelli



FEEDING (AND FUELING) THE WORLD

Cookhouse Test Kitchen

South San Francisco
October 7, 2015

In addition to sugar and eggs, this Meyer lemon cake contains a surprising ingredient: microalgae. As the world struggles to figure out how to feed 1.5 billion more people over the next 20 years, algae—which can be grown in the dark with relatively little land, energy, and water—is emerging as a viable, sustainable substitute for some fats in foods such as ice cream and salad dressing. (It can be found in Enjoy Life Foods' brownie mix.) Solazyme, a leader in manufacturing algae for food, was founded as an algae-based fuel manufacturer (it's currently a supplier to UPS). In 2011, it spun off a cosmetics company called Algenist, which had $24 million in revenue last year. Eating algae is the next frontier.
—*Adele Peters*



Photographs by Noel Spirandelli



Photograph by Elyor Nematov

Elyor Nematov/Global Assignment



AUGMENTED REALITY

KSP Steel Factory
Pavlodar, Kazakhstan
October 13, 2015

At a steel mill in Kazakhstan, a worker uses an augmented-reality "smart helmet" created by Los Angeles–based tech company Daqri to assess machinery by combining data projected before his eyes (prompted by his gazing at a black-and-white image) with his real-world observations. Daqri, which is developing hands-free tools so that factory workers, oil-rig employees, firefighters, and others can access real-time metrics without needing to fumble with tablets or laptops, is one of a swarm of nascent augmented-reality efforts targeting industry. APX Labs is developing ways for users to control factory equipment with eye motions, for example, and Google is updating Google Glass for the industrial crowd. Research firm MarketsAndMarkets predicts that augmented reality will be a $659 million business by 2018. Although smart helmets won't be commonplace for another decade, they do, like any new data-driven technology, raise privacy concerns. After all, one thing they inevitably track is the employees who wear them. *—NU*



Photograph by Alessandra Sanguinetti

MARIJUANA

Cannabis farm (name withheld)

Mendocino County, California
October 5, 2015

Until recently, scenes like this, of marijuana farmers harvesting their annual crop, would be shrouded in secrecy, but marijuana is slowly coming out of the shadows as laws criminalizing it topple one state at a time. The end of prohibition is opening up an industry that is expected to reach $8.2 billion by 2018, a figure that's hardly surprising given that half of Americans already report consuming the substance. A raft of new startups have emerged to capitalize on this market, offering marijuana-infused food and skin-care products, pharmaceutical-grade concentrates, genetic testing and analysis for growers, and more, while farmers are developing high-quality strains of the leaf. (The New Age family farmers pictured here are the exclusive suppliers to Oakland medical-cannabis dispensary Harborside Health Center.) Still, the federal government has yet to legalize the plant. Until then, marijuana entrepreneurs must walk a tricky line between building their businesses and staying clear of federal drug officers. *—Elizabeth Segran*



Photograph by Tobias Hutzler





MEDICAL TRAINING

The Dell Medical School at the University of Texas at Austin

October 9, 2015

Treating sick people is hard. Curing today's inflation-ravaged health care system, in which legacy programs thrive by treating illness as opposed to fostering health, has proved to be even harder. The Dell Medical School at the University of Texas at Austin—the first tier-one med school to be built from the ground up in more than half a century—is dedicated to reinventing medical education for a different future. The curriculum will train leaders to manage change and solve systemic problems and will be predominantly team-based (no more big lecture courses). An independent-study year in fields such as care delivery, population health and informatics, and more traditional research will also be included. A $295 million teaching hospital will serve the community's neediest, and a collaboration with the university's fine arts college, the Design Institute for Health (led by two Ideo veterans), will reimagine the entire health care process from a human-first perspective, questioning such things as the need for a waiting room. Dell, which was funded in part by a voter-approved tax increase, will welcome its first class of 50 students in June 2016. *—Evie Nagy*

Facebook

(Continued from page 100)

dates back to his experience with, of all things, phones. When the modern smartphone was being born—Apple's iPhone debuted in 2007 and Google's Android in 2008—Facebook was a red-hot startup, but there was no way it could have written its own mobile platform from scratch, let alone persuaded the rest of the industry to adopt it. By 2013, when it had a bit more clout, Facebook created Home, which slathered a Facebook-based veneer on top of Android. The notable flop reinforced the limitations of building on someone else's operating system. "One of my big regrets," Zuckerberg says wistfully, "is that Facebook hasn't had a major chance to shape the mobile operating system ecosystem." (The company has done okay on smartphones: Multiple studies show that Facebook captures more of users' mobile time than any other service.)

Oculus, then, represents two big bets in one: that VR will be the next major computing platform, supplanting phones the same way that handheld devices usurped desktops—and that human nature won't change. "If you look at how people spend time on all computing platforms, whether it's phones or desktops before that, about 40% is spent on some kind of communications and media," Zuckerberg says. "Over the long term, when [Oculus] becomes a more mature platform, I would bet that it's going to be that same 40% of the time spent doing social interactions and things like that. And that's what we know. That's what we can do." Already, Oculus helped out with Facebook's new 360-degree video feature that debuted last September.

Before Zuckerberg's vision can be realized, Oculus needs to start shipping its Rift headsets. The Facebook acquisition didn't change the company's near-term goal, which is to offer a version of Rift aimed at hard-core gamers. The closest Iribe has gotten to disclosing how much the headset will cost is saying that the all-in investment, including a PC, will be about $1,500. That includes an Xbox One gamepad, provided through a surprise deal with Microsoft. The Oculus Touch hand controllers, which are as much of a revelation as the headset and necessary for tasks such as wielding a Ping-Pong paddle, will cost extra and arrive later.

Oculus might have prospered as an independent company; among other accomplishments, it had already scored the most spectacular hiring coup imaginable by signing on legendary game programmer John Carmack (who helped create the landmark first-person shooter *Doom*) as its CTO. But like Instagram, it has benefited from Facebook ownership. "We have supercharged recruiting," says Iribe when I chat with him moments after the June media event in San Francisco, where he showed off the Oculus Touch controllers for the first time. "We were 60 or 70 people when we got acquired. And we're 360-plus today. It's just incredible how fast we've been able to grow."

Oculus has also taken full advantage of Zuckerberg's penchant for strategic acquisitions. "We come to him and say, 'Hey, there's this brilliant group of computer-vision scientists, and if they were here and working on this feature, it might be able to land in the next product or a product in two generations,'" says Iribe, who has quietly snapped up five small companies since Oculus officially became part of Facebook in July 2014. "And he's like, 'Okay, let's go do this.'"

As usual with a new venture, Zuckerberg is taking an uncommonly patient approach to making money from Oculus. "Over the long term, we need to make sure it's sustainable," he says. "But sustainable could mean selling it at breakeven and having a business around software or some other part of the platform, which is actually something that we're much better attuned to."

For Facebook, judging Oculus based on its potential is second nature. "We've got a five- to 10-year R&D road map for Oculus that's very clear about what problems we need to go take down and how we're going to do it," Schroepfer tells me. "And so we're just going to build better and better sensors and hardware and software that's going to allow you to do more and more and that's going to create these amazing experiences."

Not everyone is as convinced of Zuckerberg's VR dreams. Wall Street, for one, is having trouble peering quite so far ahead. "I worry a bit about expectations," says Colin Sebastian, senior analyst at Robert W. Baird. "Consumers have dreams of seamlessly entering these interactive environments and interacting with friends. The tech is early and the virtual environments are very basic." And the competition is intense. Sony and HTC also have VR headsets coming out next year. Then there's Google, with its Cardboard viewer that offers VR using just a smartphone and a paper case for as little as $15. Cardboard is nowhere near as compelling as Oculus, but it's cheap, approachable, and available right now.

Zuckerberg has bigger ideas in mind for what Oculus could become. When he discusses the company, he consistently refers to "VR and AR," the latter being augmented reality, the technology that layers virtual objects into the real world. (Imagine a fictional character appearing in front of you to interact with you in your home.) AR underpins Microsoft's forthcoming HoloLens product as well as the stealthy, much-buzzed-about Magic Leap. In October, both Zuckerberg and Iribe confirmed publicly that Oculus is indeed working on augmented reality. If Oculus can squeeze its technology into something that looks more like a pair of glasses and lets you see the real world as well as the virtual one, "it could be the last electronics device that a lot of people need to buy," Zuckerberg muses. And this time around, Facebook would be the company selling it.

Facebook has succeeded because it has consistently found a way to scale—its service, its business, and its ambitions. "The Facebook of today is in so many ways exactly like the Facebook of 2008," says VP of human resources and recruiting Lori Goler, who joined the company that year, when it had a mere 80 million users and less than one-twentieth its current head count. "The culture is the same. The values are the same. Mark's tremendous vision, intellect, learning mind-set—all of that is the same. What's changed is we have a lot more resources now in terms of the business growing and the number of people we have to help us move the world forward."

With the company now reaching almost 1.5 billion people, Zuckerberg can raise that last part—moving the world forward—to a new level. In August 2014, he appointed product VP Naomi Gleit, one of the company's longest-serving employees (she joined in 2005), to manage dozens of staffers dedicated exclusively to implementing functionality that helps Facebook members do good. A donation tool, launched last year, allows users to respond to disasters by giving money, a task that—Facebook being Facebook—it sees as an engineering problem that should be attacked through continuous iteration. "I geek out on this, but with the Ebola campaign we asked users to select a donation amount," explains Gleit. "We also asked them to pick a specific charity that they wanted to donate to." This proved confusing to users and did not produce as much giving as Facebook hoped. "With the Nepal campaign we reduced it from five steps to two," Gleit says. "We had a preselected donation amount, and we chose multiple charities and then distributed among them equally."

Tools like this "maybe only can happen on Facebook, or can happen uniquely well on Facebook," says Zuckerberg (who, along with his wife, Priscilla Chan, a pediatrician, has given $1.6 billion to various causes). "I think about the organ-donation listing work that we did. The Safety Check stuff that we've done, where 150 million people were notified of their friends being safe in the [Nepal] earthquake. You can only do that if you've mapped out what people's relationships are, and you have a sense of where people are in the world, and you have a tool that they're checking every day." He's right: Facebook can indeed do things no other company can.

But it can't do anything for people who remain disconnected from the digital world. "If we really want to connect everyone in the world and give everyone the ability to have a voice and share what they want with the people around them, then you can't just build the biggest Internet service," Zuckerberg says. "You also have to help grow the Internet." In 2013, Facebook enlisted Nokia, Qualcomm, Samsung, and other tech giants to help it found Internet.org, the global-connectivity initiative dedicated to bringing the Internet to the 60% of people worldwide who aren't yet online.

The effort is a hybrid of short-term altruism and long-term capitalism. "The fundamental connectivity problem is a financial one," Sandberg explains. "For 90% of the people, it's cost. The World Bank puts absolute poverty at about $1.25 a day. One in six people live under that. If you're the average connected Facebook user in the U.S., you spend a dollar a day implicitly on data. So the business models have to change, and the cost needs to go down. And that's what we're trying to do."

"It's not lost on our businesses that as economic standings improve, there will be opportunities, but that's not the initial goal," adds Matt Grob, CTO of Qualcomm. "We've seen throughout the world that when you provide improved connectivity, people are more able to educate their children and participate in political and government activities and sell their wares or find jobs."

Internet.org's first effort—an app offering free access to Facebook, news, search, job listings, and other services—is live in India, Indonesia, Pakistan, the Philippines, South Africa, and 17 other countries. Facebook has deployed it in collaboration with local wireless carriers, and almost 10 million people are using it. But the app has received pushback on multiple grounds, particularly for offering only certain curated services rather than the full, unbridled Internet—a violation, critics say, of net neutrality principles.

The debate has been particularly heated in India: Investor Mahesh Murthy charged that giving poor people free access to a sliver of the web amounted to "economic racism," and several major media companies that had joined the effort pulled out.

For Facebook, releasing something, gauging reaction, and then tweaking as necessary is not only normal but also a badge of honor—after all, one of the company's guiding principles is "Done is better than perfect." When I ask Zuckerberg about the controversy, he says, "Internet.org is working. We've learned a lot from our efforts already. We've listened to a lot of feedback from people in the communities we're connecting and have responded by making significant changes to the program." Among other adjustments, it's made the app more secure and private and now lets any third-party service submit itself for inclusion, subject to technical restrictions. Given time, the company might get the Internet.org app to a place that's relatively uncontroversial. Even now, it has its allies. "I firmly believe that at this point, some Internet is better than no Internet," says Helani Galpaya, CEO of LIRNEasia, a communications think tank based in Colombo, Sri Lanka.

For the places on earth where there's currently no Internet, Facebook and Internet.org are tackling that issue too. In terms of land area, explains Yael Maguire, director of Facebook's Connectivity Lab, "there's only 10% of the world that is not able to connect if they pulled out a phone. The focus for this lab, going back to the mission of the company, is to figure out how we can connect the last 10%."

Talking with Maguire, you quickly see why Zuckerberg entrusted him with this challenge: The way he rattles off stats and facts and calmly deconstructs goals that sound nearly impossible is reminiscent of his boss's own manner. Facebook opened the Connectivity Lab in March 2014, and Maguire and his team have concluded that the answer to their challenge is a drone—although Maguire prefers the less-politicized (though not exactly catchy) term HAPI Link, which is short for high-altitude platform Internet link. By charging an unmanned aerial vehicle's battery via solar power and flying it at 60,000 to 90,000 feet, above weather and conventional aircraft, the company believes it could efficiently send high-speed Internet access down to where it is needed via laser.

Facebook began the project with more hardware engineering experience than you might imagine. It started accumulating this more than a half-decade ago, when execs decided that the best way to deliver Facebook reliably and efficiently to hundreds of millions of people was to construct its own data centers and fill them with its own servers. That path led to the Open Compute Project, Maguire's purview at Facebook prior to the Connectivity Lab, which created power-efficient, easy-to-repair servers that the company could install by the thousands in data centers located everywhere from Prineville, Oregon, to Luleå, Sweden. Rather than treat its designs as proprietary, Facebook shared them with the rest of the industry via a not-for-profit that grew to include support from Apple, Dell, HP, Intel, and Microsoft, among others.

"When I joined, we didn't have mechanical engineers," says Open Compute Project Foundation board member Frank Frankovsky, who headed hardware design for Facebook's servers before leaving in 2014 to cofound a storage startup. "We hired some of the best in the world. And guess what? Drones need mechanical engineers, too."

The company acquired instant expertise in unmanned aeronautics in March 2014 by plunking down $20 million for Ascenta, a U.K.–based startup founded by Andrew Cox, whose previous efforts included a military drone that set a world record by staying aloft for almost two weeks.

As in the past, hearing Mark Zuckerberg explain his vision proved to be a powerful recruiting tool. "I personally called up the guy who's leading our laser-communications effort, who was working at [NASA's] Jet Propulsion Laboratory," he recalls. "And he said, 'What? Why are you calling me?' And I said, 'Because we're connecting the world, and I want you to come in and meet the team, and this is something that's really important to me, and I think we can make a big difference.' " Even in the retelling, Zuckerberg makes it sound urgent.

Fourteen months after the Ascenta acquisition, Facebook announced that it had a full-scale prototype, dubbed Aquila and crafted from ultralightweight carbon fiber. An empty next-generation Boeing 737-600 airliner weighs upwards of 80,000 pounds and has a 113-foot wingspan; Aquila has a 138-foot wingspan, yet weighs only 880 pounds. The company plans to begin test flights by the end of 2015. Once the planes are manufactured, Facebook plans to partner with local telcos to deploy them.

For all the quick progress the Connectivity Lab has made, much remains to be done. It's still developing the battery technology necessary to keep the drone in the air for three months, the company's goal. And though it's figured out how to use lasers to transmit data at blistering speeds in the tens of gigabits per second, thanks to technology borrowed from Facebook's data centers, it is still ironing out the details of drone-to-drone phone communication.

Then there are the FAA regulations, which require that every drone have a dedicated pilot on the ground controlling it, a restriction that Maguire says would make Aquila economically unworkable (the same is true of Google's Project Loon Internet balloons; the two fierce competitors are collaborating to work through some of the policy implications). The solution? Computer science. "We need good machine-learning algorithms and control algorithms," Maguire says, "to make it so that you have 1,000 planes per pilot or . . . I don't know what the number is, but somewhere between 25 and 1,000."

Zuckerberg, who personally researched and wrote a meaty, unsigned Facebook white paper on the state of connectivity, is, as usual, unfazed. And with 54% of the voting power of Facebook stock in his control, bouncing ideas off his board of directors is as close as he ever gets to seeking permission for his plans. "The myth is that Mark makes decisions and informs the board," says director Andreessen. "The reality is that we have very detailed discussions."

As Zuckerberg recalls, the board asked him, " 'You're going to spend *how* many billions of dollars on this? And *how* is this going to make money?' And I said, 'Well, I don't have a direct plan now, but I just believe that if we connect these folks it will be good. And it will help those economies grow. And those people have better lives. And I think some portion of that will come back to us over some period of time.' "

Zuckerberg has earned the right to trust his gut. "At the beginning of Facebook, I didn't have an idea of how this was going to be a good business," he tells me. "I just thought it was a good thing to do." He pauses. "Very few people thought it was going to be a good business early on, which is why almost no one else tried to do it."

Today, everyone understands: Not worrying about whether Facebook was a good business turned out to be a great way to do business. Zuckerberg has recalibrated his ambitions accordingly. As Andreessen tells me, "This is a guy who's 31. He's got a 40- or 50-year runway. I don't even know if there's a precedent." FC

hmccracken@fastcompany.com

Malala

(Continued from page 109)

that I just feel I am part of them. We belong to the same world."

Before the Malala Fund stepped in, the language of the UN's Sustainable Development Goals made clear that nine years of education for the world's children was a reasonable-enough target for the UN to fight for. This was unacceptable to Malala: Why not 12 years? "When she and the fund took on this fight, the overwhelming number of people, organizations, and governments said, 'It'll never happen, you won't win this one,'" says Jordan.

"Oftentimes problems seem intractable," says Stone, who while working on the ONE campaign learned the art of systematic attack. "But if you really map it out, sometimes it comes down to three, four, five people sitting in different capitals around the world just deciding. And you need to reach them." So Malala spent months meeting with decision makers, from the Global Partnership for Education (dedicated to bettering school conditions in 60 developing countries) to German chancellor Angela Merkel.

She has garnered enough support that when the Sustainable Development Goals were presented at the UN in September, the language of the working documents had been changed to 12 years. If it holds (the terms of the documents will be ratified in March), the world will have taken a stand about a child's basic right to a full secondary education. It will shift the way international assistance is given, provide a framework to measure how donor and developing countries are responding to new expectations, and potentially grant millions of girls access to the education they need to be globally competitive. And it will be thanks almost entirely to the Malala Fund.

Of course, Malala isn't taking any of that for granted. In the fall, the fund launched #withMalala, a social media effort asking people to support her petition demanding that the Global Partnership for Education fight for 12 years of school as opposed to nine. During its first four days, according to Keyhole.co, the campaign reached more than 17 million people.

"When I was little, I believed in magic," says Malala, in the D.C. offices, shifting her head scarf back into place. "I used to believe in a magic pencil, and whatever you could draw it would become real. I used to pray to God a lot so that he would give me this power so I can change the world. And I realize that I have this power now. It is education. It is voice. It is the young people standing with me. It is my strong father and mother. It is the strong team of the Malala Fund. So I realize I have found that power, and it isn't linked to that magic pencil, but rather the pencil of knowledge. It might take time, but things will change. Things will change."

I ask her if sometimes she can't help but feel burdened by the weight of her pencil.

"No! I wish I had lots of magic pencils," she says. "Okay, the only thing that worries me is to make sure that my studies are not affected."

During the school year, unless there's a global summit, say, Malala stays in Birmingham, so she can be in class. She reserves all travel for her fall and winter breaks, though she speaks with Stone and the team nearly every day. "And I do work on the weekends," she says. "We have board meetings, calls, the [social media] campaign." After receiving the Nobel Prize, Malala hunkered down for six months to prepare for England's rigorous GCSE tests. Her father tweeted to the world the results of her efforts: "My wife Toor Pekai and I are proud of Malala getting 6A*s and 4As. #education for every child." Malala's mother, who dropped out of school as a young girl in Pakistan, has learned to read and is starting to learn English.

Malala hopes to go to college at Stanford or Oxford and plans on studying either politics or economics. She long harbored the dream of becoming the prime minister of Pakistan, but now she's not sure. "In our country, if you want to become a prime minister you have to be 35 years old," she says. "I can't wait until I'm 35 and say, 'Okay, now I'm starting my job!' So I've not decided what I want to do, but I have decided what I *don't* want to do," she continues, reaching up shyly to cover her smile. "I don't want to become a doctor, and I don't want to become an engineer."

Right now, her most important job is just being a student. "Malala's school will always come first," says Stone. "She gets hundreds upon hundreds of requests every week from all over the world to speak. But no matter how incredible an opportunity or high level an invitation, if it conflicts with a quiz or a class, she asks that we very graciously decline on her behalf. You'd be surprised how many people say, 'Yes, but can't she come anyway?'"

Malala shakes her head firmly at the idea. "I consider education the key to success for every other girl," she says. "It's the key to success for me as well." FC

loop@fastcompany.com

ANSWERS TO THE CROSSWORD FROM PAGE 144:

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(4)	Paid Distribution by Other Classes of Mail Through the USPS (e.g., First-Class Mail)	0	0
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D.	Free or Nominal Rate Distribution (By Mail and Outside the Mail)		
(1)	Free or Nominal Rate Outside-County Copies Included on PS Form 3541	140,353	131,007
(2)	Free or Nominal Rate In-County Copies Included on PS Form 3541	0	0
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(4)	Free or Nominal Rate Distribution Outside the Mail (Carriers or other means)	16,826	17,853
E.	Total Free or Nominal Rate Distribution (Sum of 15d [1], [2], [3], and [4])	157,179	148,860
F.	Total Distribution (Sum of 15c and 15e)	758,705	744,922
G.	Copies Not Distributed	96,791	105,900
H.	Total (Sum of 15f and 15g)	855,496	850,822
I.	Percent Paid (15c divided by 15f times 100)	79.28%	80.02%
16.	**Electronic Copy Circulation**		
A.	Paid Electronic Copies	63,348	60,000
B.	Total Paid Print Copies (15c) + Paid Electronic Copies (16a)	664,874	656,062
C.	Total Print Distribution (15f) + Paid Electronic Copies (16a)	822,053	804,922
D.	Percent Paid (Both Print & Electronic Copies) (16b divided by 16c times 100)	80.9%	81.5%

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Elon Musk

(Continued from page 116)

Musk has always had an appetite for risk. Tesla's original plan, as conceived by founders Martin Eberhard and Marc Tarpenning, had been to commercialize an electric sports car developed by a small Silicon Valley research shop, AC Propulsion, using low-cost, off-the-shelf components, including inexpensive laptop batteries. Musk, who initially joined as an investor but quickly took an active role in the vehicle's design, described it at the time as "an electric car without compromises," announcing that the Roadster would sell for $89,000 and that the company would use the profits from the sports car to fund cheaper cars as lithium-ion battery prices inevitably fell.

There was one problem: There were no profits—not even close. The cost of the original Roadster wound up totaling nearly $200,000, causing Musk to fire Eberhard, the company's first CEO. "Everything in that business plan was wrong," Musk says. (In a 2009 lawsuit, Eberhard claimed that Musk had forced him out in an attempt to take over the company. The lawsuit was settled in mediation.) Musk would cycle through two more CEOs, pouring what was left of his PayPal fortune into Tesla and SpaceX, which also struggled to stay afloat after the 2008 economic collapse, eventually taking over day-to-day management himself. "It just made sense," he told *The New York Times* at the time. "We're going through a very difficult economic period, and I've got so many chips on the table with Tesla."

Musk adopted a joint-custody-style arrangement with Tesla and SpaceX—Mondays, Thursdays, and Fridays, he would be at SpaceX in Los Angeles; Tuesdays and Wednesdays were Tesla days in Palo Alto. He redesigned the Roadster's motor and transmission to bring costs under control and went on a marketing blitz that helped convince customers to accept a price increase. He raised $50 million from Daimler and another $50 million from Toyota and managed to score a $465 million loan from the Department of Energy. (Tesla paid the government back in 2013.)

In addition to serving as CEO, Musk was Tesla's product architect, moving the company's design studio to Los Angeles and obsessing over small details like the Model S's light switches and door handles, while two teams of engineers worked in shifts around the clock. Tesla went public in 2010, and the Model S was greeted with rapturous reviews when it debuted in 2012, but the company nearly went bankrupt for a second time the following year when customers were slow to embrace an unproven car company offering unproven technology.

That the orders for the Model S eventually came in helped transform Musk from a sort of Silicon Valley eccentric—someone who was able to captivate the press but wasn't always taken all that seriously by investors or his fellow CEOs—into someone who was seen, in the words of Ashlee Vance, author of *Elon Musk: Tesla, SpaceX, and the Quest for a Fantastic Future*, as "America's most adventurous industrialist." Vance's book, which came out earlier this year, paints Musk as the lone entrepreneur willing to apply Silicon Valley thinking "to improving big fantastic machines" and who had created "the automotive equivalent of the iPhone."

Musk seems uncomfortable with this portrayal. When I suggest that getting into the home-battery business seems like an odd departure given that Tesla is a car company, he seems exasperated. "The goal has not been: Let's make cars," Musk says. "The goal has been: We need to accelerate the advent of sustainable energy."

On top of everything else, Musk serves as chairman of SolarCity, the solar panel installer. (Musk's cousins, Lyndon and Peter Rive, started the company after Musk pitched them on the concept while the three were driving to the Burning Man festival in 2004.) SolarCity and Tesla have collaborated for years in small ways, such as marketing solar panels to electric-car owners who want to charge their vehicles using sunlight. But Musk has long seen Tesla's batteries as having applications beyond cars. Starting around 2007, he instructed his chief technology officer, JB Straubel, to begin researching the idea of using Tesla batteries attached to solar panels in people's homes. "This has been something that has been in the back of our minds," says Straubel, who uses a hacked-together solar panel and battery system of his own in his Bay Area home.

Musk sees his foray into home batteries as an inevitable extension of Tesla's mission—and a necessary response to the basic facts of alternative energy in the United States. Solar power accounts for less than 1% of our total electric production in part because it has a significant limitation. As Musk puts it archly, "The sun doesn't shine at night." Starting in the late afternoon, when a typical household is using a lot of electricity to run air conditioners, televisions, computers, and maybe the oven, the energy production of a solar panel plummets, falling to zero by sunset.

This gave Musk an idea: Why not just use the same batteries that power Tesla cars in people's homes? People could charge the batteries when the sun shines brightest and then use them at night to drastically reduce their dependence on their energy company. "It's pretty obvious really," Musk says. "In fact, that's what my 9-year-old said: 'It's soooo obvious! Why is that even a thing?'"

The drive from downtown Reno to the site of Tesla's new battery factory takes 30 minutes or so along a mostly empty stretch of Interstate 80 that heads west through the high desert of the Sierra Nevada foothills. You pass the smokestacks of a power plant, the exit for the Mustang Ranch, Nevada's first legal brothel, and wide expanses of brown scrub. On the day I made the trip, the landscape was covered in a thick haze from wildfires that were burning in California to the west, giving the place an eerie quality and making it hard to spot the herd of 1,400 roaming wild horses that still graze in the hills. "It's very romantic," Musk had told me a few weeks earlier.

I don't think he had only the horses in mind when he said this. Northern Nevada's high desert is an ideal place for the technology industry, with its low wages, cheap energy, and a climate that may not be especially hospitable to foliage but is nearly perfect for data centers—and, as it turns out, for the manufacture of lithium-ion batteries. (Battery production requires very low humidity.) Moreover, there's lots of room to expand, and Musk has already acquired around 3,000 acres of land, all of it previously unbuilt.

No journalist had ever before visited what Tesla calls the Gigafactory, which opens next year but won't be completed until 2020. (And not for lack of trying. In October, a photographer from a Reno paper was arrested after sneaking onto the property and allegedly assaulting security guards as they tried to eject him.) Musk had warned me that the scale of the place would be overwhelming. "It will blow your mind. You see it in person and then realize, Fuck, this is big."

He was right. It was impossible not to feel awestruck by the sprawling, 71-foot-tall structure stretched out, miragelike, before me as I drove into a shallow canyon. The building—which is so long that it has to be broken up into four distinct structures with four different foundations so that an earthquake can't tear it apart—comprises 1.9 million square feet of factory space. That's pretty big. It's the size of a major shopping mall, but, as I was told by a senior Tesla executive, it accounts for only 14% of the total planned floor space, which will reach 13.6 million square feet. When the Gigafactory is finished, it will be only slightly smaller than Boeing's Everett, Washington, plant, which is the world's largest building by volume. The Gigafactory will be the second largest, and Musk has hinted it could grow bigger.

Despite all this, the Gigafactory is not some extravagance. Musk's team is currently designing a much lower-cost Tesla car, the $35,000 Model 3, which promises the performance of a similarly priced gasoline car and a 200-mile range. But to offer that car in Toyota-like quantities, Tesla will need many more of the 18650 batteries used in its cars, as well as in its Powerwalls and Powerpacks.

A 18650 lithium-ion cell is 2.6 inches long and 0.7 inches wide, a stubby little cylinder encased in brushed metal. Hold one in your hand and you'd be forgiven for mistaking it for something that might go into your television's remote control. In fact, 18650 batteries still power many laptops. However ubiquitous they may be, there aren't nearly enough of them for Musk's needs. "One hundred thousand is roughly the limit," Musk says, referring to the maximum number of cars Tesla could make each year if it bought all the

world's batteries, one-fifth of his goal. "So it's either build a whole bunch of little factories or one big factory. And a whole bunch of little factories sounds like quite a bother. Why not just have one big one and maximize your economies of scale?"

I ask Musk why he didn't simply make this a problem for Tesla's main supplier, Panasonic. Battery manufacturing is not a high-margin business—Panasonic's automotive division makes 3.1% margins—and it also happens to be one in which Tesla has no experience. He looks at me as if I were a California jury commissioner. "Why would they believe us?" he asks. "It's hard to convince people from consumer industries that you're going to make 15 times as many cars as you're currently making. That sounds pretty implausible. We just had to say we're going to do it, and you're either on the ride or you're not." (In 2014, Panasonic and Tesla signed an agreement that essentially makes Panasonic a tenant in the Gigafactory, manufacturing the cells and passing them to Tesla employees to put in battery packs.)

It does indeed sound implausible, and it shows just how precarious the coming years will be for Musk, assuming he wants Tesla to remain independent. The company has lost money in every year of its existence and has had only one profitable quarter (nearly three years ago). The company's projected output for 2015—50,000 cars—means that it is producing basically five cars per employee. BMW, by comparison, will ship 2 million cars this year, 17 for every person who works there. The new Tesla Model X, a $132,000 crossover SUV with improbable gullwing doors and a third row of seats, is drawing raves; the hope within Tesla is that it will attract more women to the brand. But there are only so many people who can (or want) to spend that kind of money on a family car. (Cheaper versions of the Model X will eventually be released, but those will still cost around $75,000.)

Moreover, electric cars won't simply become cheap by magic because, unlike gasoline cars, they are limited by their batteries. The only way to make a cheaper electric car has been to drastically reduce how fast and how far it can go, by offering cars with batteries that provide less power and less energy. This is why the Nissan Leaf, with a retail price of just under $30,000, has a range of only 84 miles (one-third that of the Model S) and takes three times as long to get to 60 miles per hour. There is simply no way to put the Model S's current battery, which analysts estimate costs about $15,000 just to manufacture, in a $35,000 car and not lose your shirt. "The biggest leverage we have on making electric vehicles more affordable for everyone is reducing the battery cost," says Straubel.

And because a big breakthrough in battery technology is unlikely, there's basically one way to reduce the costs: Make and sell lots of them very efficiently, taking advantage of epic economies of scale. Dan Dolev, an analyst with Jefferies, recently predicted that the Gigafactory's huge volumes will help cut the cost of Tesla's batteries in half, essentially making the Model 3 possible. That's why Musk is pitching home battery packs. "If we can create huge demand for batteries," Straubel continues, it will create "this virtuous cycle of reducing prices further."

In 2005, during a commencement address at Stanford, Steve Jobs suggested that graduates always be mindful of the brevity of life. Jobs, who had recently been diagnosed with pancreatic cancer, told the class that since his teenage years he had "looked in the mirror every morning and asked myself, 'If today were the last day of my life, would I want to do what I am about to do today?' " He continued: "And whenever the answer has been 'No' for too many days in a row, I know I need to change something." In the months before his death, in 2011, Jobs seemed to regard his life's work —the creation of the personal computer and then the iPhone—as complete, telling biographer Walter Isaacson, "I've had a very lucky career. . . . I've done all that I can do."

Musk is more restless than Jobs ever was, but it's hard to escape the sense that however proud he is of his accomplishments to date—the creation of several world-changing startups, the rehabilitation of the electric car, the rekindling of interest in space travel—it's not enough. Jobs never talked about the distant future or what the iPhone might look like in 2050; for him, the iPhone of today was worth celebrating. Musk talks about the distant future incessantly and seems halfway ashamed by his past and current accomplishments. PayPal made him rich, but Musk has often suggested that the company could have been much, much bigger. Last year, at a conference, Musk suggested that key decisions regarding the Tesla Roadster had been "dumb" and that the company had erred by not designing the first version of its electric car from scratch. "It's like if you have a particular house in mind and instead of buying that house, you buy some other house and chop down everything except one wall in the basement," he said.

In other words, Musk does not feel that the world would be okay if he died tomorrow in a horrific wing-walking accident. When I ask him what would happen if gasoline cars simply continued to improve in efficiency, he says, "I think people should be a lot more worried than they are," explaining that even if carbon dioxide levels remain what they are today, we won't feel the ill effects until at least 2035. "Life will continue, but it will be a train wreck in slow motion," he says, perhaps resisting the temptation to note that no, we won't all have to go live on Mars yet. "Millions of people will die; there will be trillions of dollars in damage—that sort of thing."

Musk believes that the key to avoiding this fate will be inexpensive batteries like the Powerwall and Powerpack. In 20 years, he predicts, at least 10% of the world's fossil-fuel power plants will be mothballed thanks to the batteries alone. After all, battery power would obliterate the need for so-called peaker power plants, which utilities run—almost exclusively on fossil fuels—mostly on summer afternoons to avoid brownouts when everyone turns on their air conditioners. "We have these big engines that we might run for three hours a year," says Mary Powell, CEO of Green Mountain Power, a Vermont utility. "They're expensive to build and expensive to maintain." And if Green Mountain can't make enough energy to meet its customers' needs, it is forced to buy electricity from other states on the spot market—meaning it pays as much as 10 times the normal rate.

To try to avoid this in the future, Powell plans to offer the Tesla Powerwall to her customers as an add-on. For $30 a month, Green Mountain customers will get a Tesla battery that would save them in the event of a power outage while allowing Green Mountain to tap into the batteries rather than using backup generators when demand spikes on hot days. Eventually, she thinks that the savings from this approach could allow her company to give the batteries to customers for free.

But things really get interesting once Musk's batteries are paired with solar panels. "In five years, solar panels will have three times the capacity and half the cost—and the storage will be much more efficient," says Ernesto Ciorra, head of innovation and sustainability at Enel Group, the Italian energy giant. Ciorra predicts a wave of disruption akin to the advent of mobile phones, as consumers in rich countries increasingly use solar panels and batteries to reduce their utility bills and those in poor countries use them to stay off the grid entirely. "The energy companies that follow this track will get more money," Ciorra says. "The ones that do not evolve will close."

Musk, never one to shy away from the social implications of a marketing message, says that in rural parts of Africa and Asia, having a solar panel and batteries "is the difference between having electricity and not having it." Of course, he also believes his new battery packs will appeal to Americans. "I suspect after a natural disaster the appeal of the Powerwall will increase substantially," he says. "You'll know who has the Powerwall 'cause he'll be the one guy in the neighborhood with the lights on."

Tesla employees say that in addition to making batteries cheaply, Musk has given them another directive: Make the factory beautiful. Tesla's cars distinguish themselves by their performance, but Musk has always been attentive to the curve of a windshield or an intuitive door handle. Additionally, the Gigafactory must be attractive because Musk sees it as a product—something that has been carefully planned, where everything fits together with a certain harmony. He wants it to be beautiful, in part, because he plans to build more than one.

"We're going to need probably, like, 10 or 20 of these things," he says. He pauses, raises his broad shoulders toward his ears, and smiles. "Somebody's got to."

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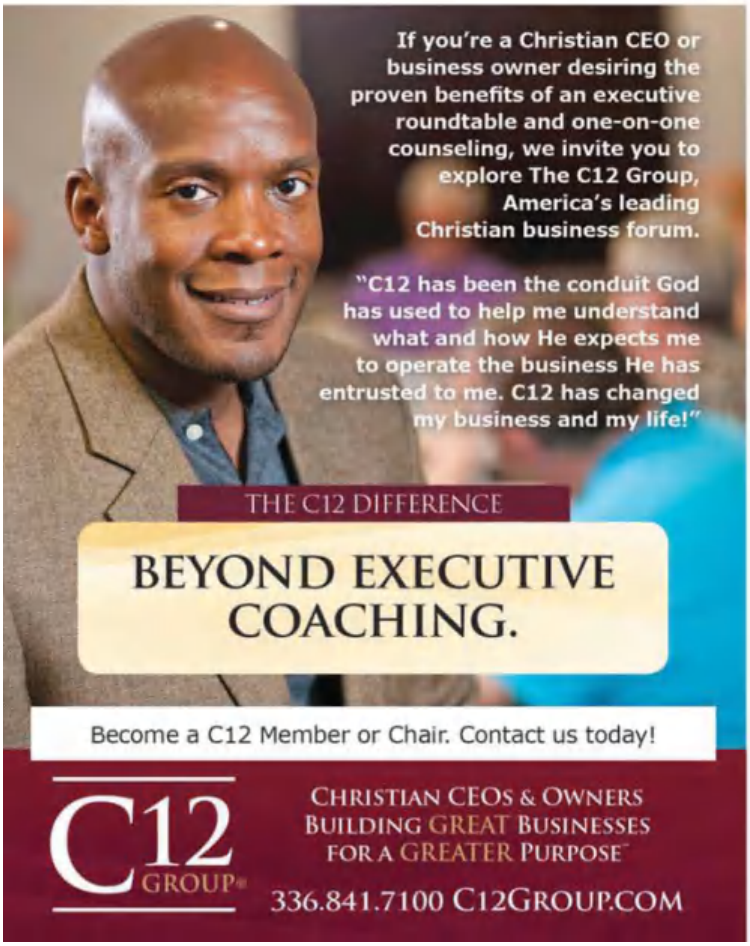
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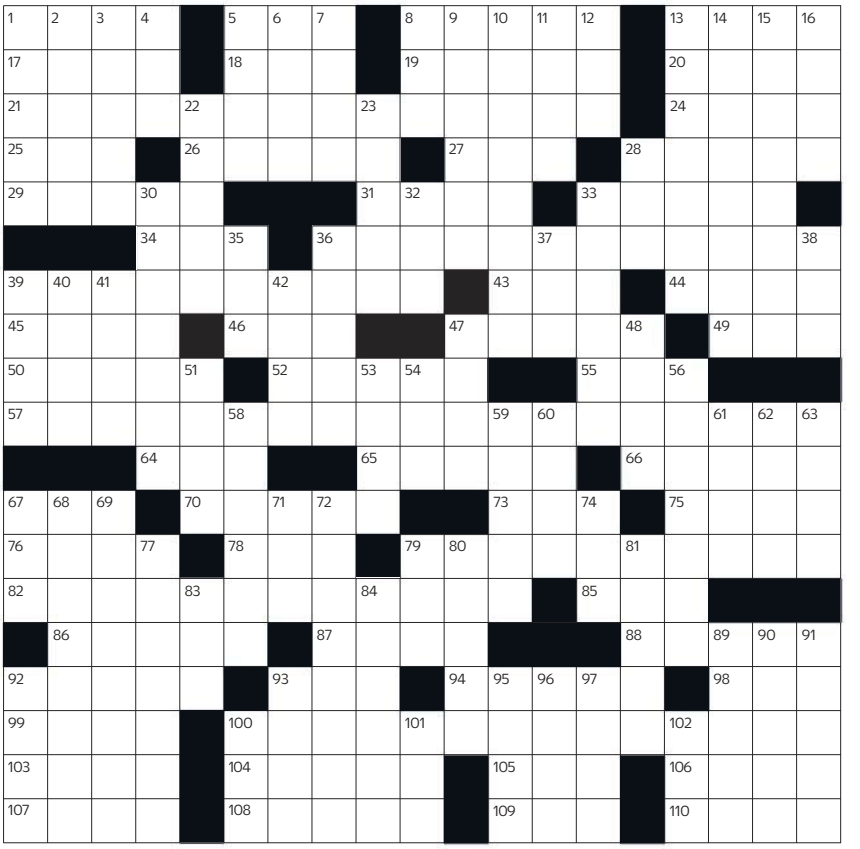
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Crossword

Punny business

By Brendan Emmett Quigley



ACROSS

1. '70s Swedish band
5. Place to get shellacked?
8. Actress Cornish
13. ___ chowder
17. Palm smartphone
18. *Lord of the Rings* CGI monster
19. Exotic fruit flavor
20. Freight-car hopper
21. Fine-arts hub for an online professional network?
24. Sustainable sci.
25. Massachusetts Cape
26. Pint selection
27. Cold and calculating
28. Extremely serious
29. Microsoft's video chat
31. "Hey, sailor!"
33. Social psychologist Durkheim
34. Article in *Le Soir*
36. Result of Chinese company's focus on bridge building?
39. What Elon Musk does before getting in the tub?
43. Valentine misspelling
44. Place to stream *The Mindy Project*
45. iOS daily-planning app
46. Psych 101 subject
47. Uncomfortably strange
49. Sandwich classic
50. "We didn't do it!"
52. "Kill da wabbit" speaker
55. San Francisco–to-Stockton dir.
57. State where Naval Academy cadets aren't able to use iPhones, Macs, etc.?
64. Where Carnival and Disney cruise
65. ArcelorMittal product
66. Politician Stevenson
67. *Breaking Bad* drug lord Fring
70. Acknowledges a great performance
73. Take a bit off the top
75. "___ kleine Nachtmusik"
76. Literary collections
78. Nike shoe technology
79. Blockage of shared rides between Arizona and Nevada?
82. Vatican blesses online financial transactions?
85. Hedge-fund analyst turned educator Khan
86. Scratch
87. Rough up badly
88. The "Cisco" that delivers food
92. Kicks the football away
93. Little taste
94. English philosopher John, or *Lost* castaway John
98. Spalter who is head of design at Instagram
99. Actor Morales
100. Line of musical action figures based on Larry Page, Sergey Brin, etc.?
103. Squishy toy company
104. Older show selection off 44-Across
105. Have second feelings about
106. "Would ___ to you?"
107. Deadline for action
108. Perfect places
109. Shocking fish
110. Company known for its pink moustaches

DOWN

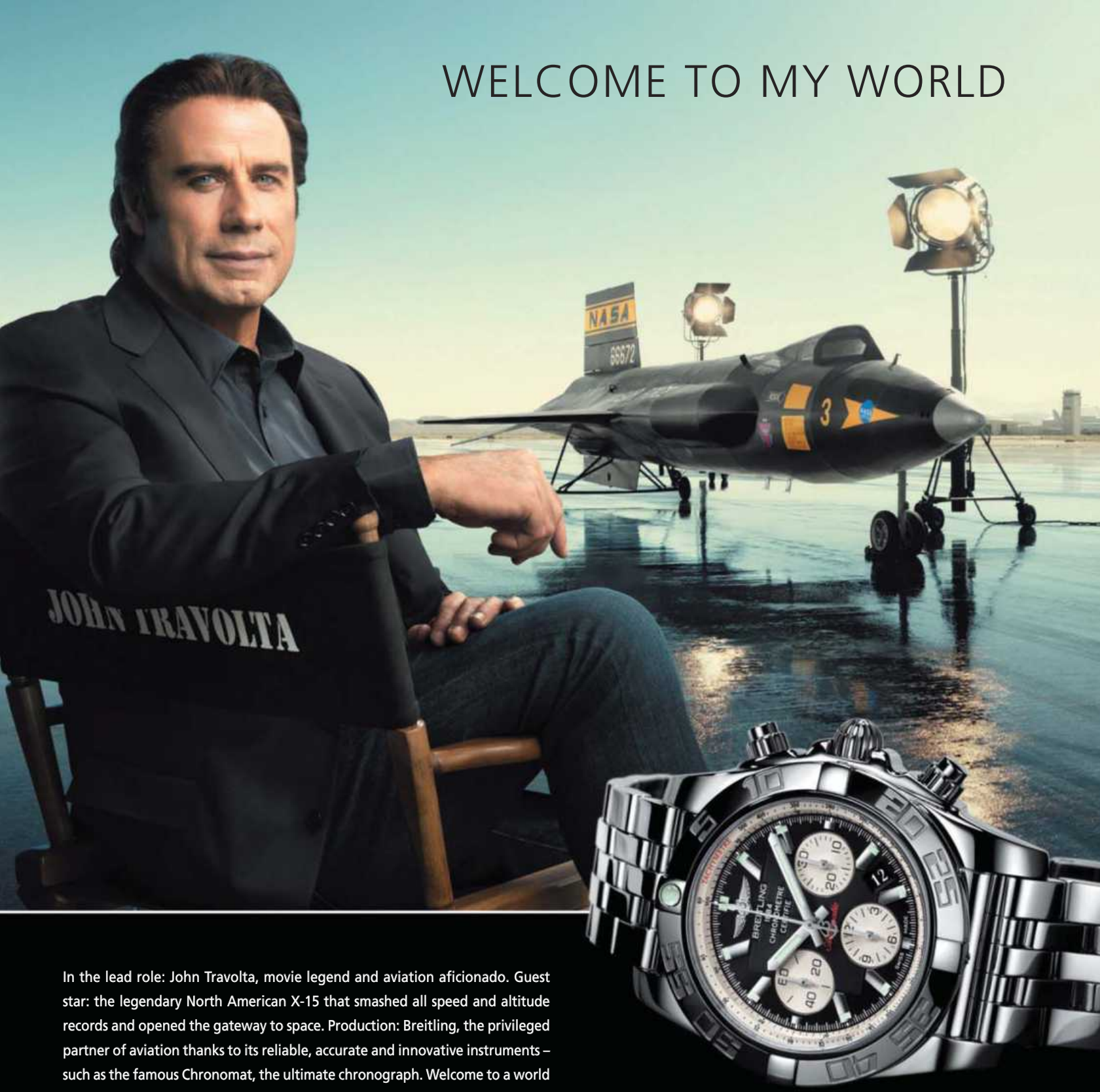
1. Place for a world view?
2. Edge of a precipice
3. One of 1-Across's B's
4. Just ducky
5. Pepsi but not Gatorade
6. One easily offended
7. Accutane treats it
8. Number on a birthday cake
9. Toe inflammation
10. Caped Crusader's three-wheeled vehicle
11. Poker champ Phil
12. Beats by Dre coverage?
13. Love to bits
14. Neighborhood place to get a pint
15. First and foremost
16. Double agent
22. Anonymous Italian author Ferrante
23. Barrel partner?
28. U.K. hours
30. Huggies for toddlers
32. Guy-falls-in-love-with-an-OS movie
33. Green-eyed one
35. Pecorino-cheese source
36. Key ring?
37. Home of IBEX, DAX, etc.
38. Planters staple
39. Comic Fey
40. Yellen subj.
41. ___ spell (took a load off)
42. Stand-up comic Steve
47. Gael talk
48. "A Day Without Rain" singer
51. Freelancers often write on it
53. Total snafu
54. Super suffix
56. Getting on in years
58. "I'm not paying attention to you"
59. Bench-clearing brawl
60. Baseball's Jesus
61. "Put ___ on it"
62. Grandma's nickname
63. Per ___
67. Owner of Athleta and Banana Republic
68. Not laughing
69. Geisha's goodbye
71. Provide help
72. Film's opening
74. *American Experience* channel
77. "Music for everyone" app
79. ___ Vue (eyeglass manufacturer)
80. Slogan for the first iPhone ad
81. Relaxed
83. Ice Bucket Challenge target
84. Kiddie weapon
89. Goofy
90. Where *Silicon Valley* is based: abbr.
91. Beginning
92. Stay unsettled
93. Lose, as one's coat
95. Shrek, e.g.
96. Colonel Mustard's game
97. Tumble (over)
100. *Uno e due*
101. Put-___ (pranks)
102. What fuels ExxonMobil

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For puzzle answers, turn to page 138


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